eSL/eAM Series (+eSLZ000)

INTEGRATED DEVELOPMENT ENVIRONMENT

USER'S GUIDE

DOC. VERSION 1.8

(Applicable to eSL/eAM IDE Version 1.0 & later)

ELAN MICROELECTRONICS CORP.

Nov 2007

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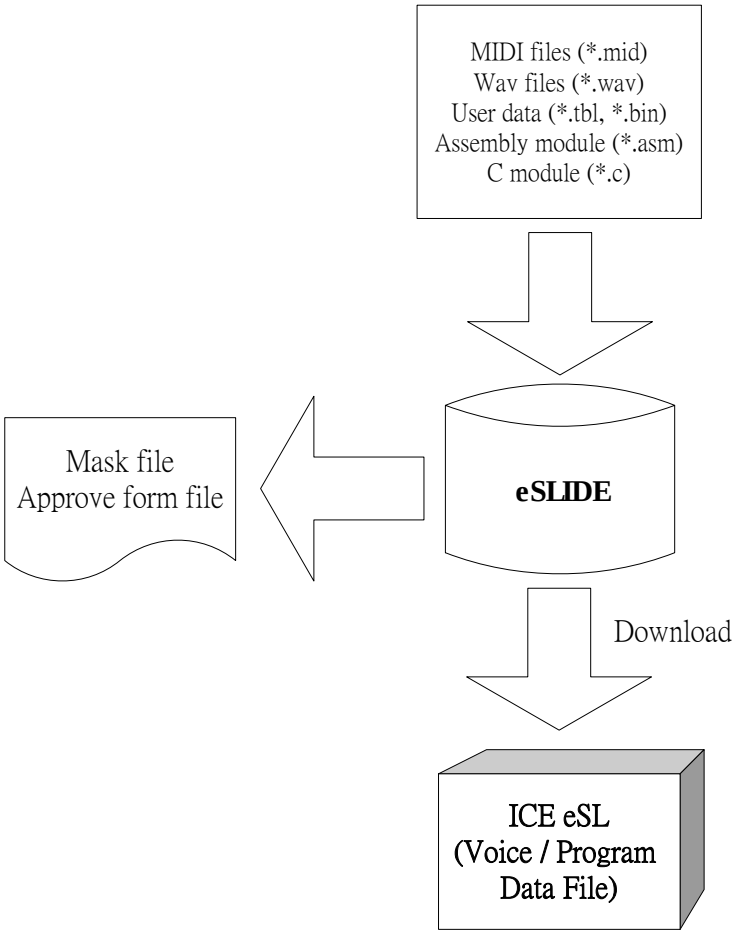
1.1	Add eAM serial chip and speech ADPCM coding type	2006/6/7
1.2	Add How to create and use SPI Project	2006/7/10
1.3	Add some note and ezwave icon and relate command	2006/7/20
1.4	Modify appendix D and modify assemble watch window content Update compiler option window	2006/8/15
1.5	Modify Customize Option Dialog content Add Speech Overview window section	2006/12/19
1.6	N/A	2007/4/16
1.7	Modify Speech Property Dialog content Modify Customize Dialog content	2007/8/23
1.8	Add speech coding type Type2-1, Type2-2 Remove Speech coding type Type2 Modify Speech Coding Type Setting dialog content EMF Download add SPI Flash Download information	2007/11/19

Chapter 1
Introduction

1.1 Overview



eSL/eAM Integrated Development Environment

1.2 Introduction to eSL/eAM IDE Program

The eSL/eAM IDE Program is a Windows-based program that is used among other things, to develop embedded programs for eSL/eAM series microcontrollers. The embedded program is developed by taking one or more source files in assembly language and translate them into object files that are linked to each other along with one or more libraries. The created executable program is then downloaded to ICEeSL for simulation, verification and debugging.

1.2.1 Tools under File View and Voice View Modes

The eSL/eAM IDE Program is integrated with the following resourceful tools**:**

1.2.1.1 File View Mode

- **Project Manager** that create, save, open, and closes project. It also manipulates the existing project and source files that are part of the project
- **Editor** that provides editing functions for creating, viewing, and modifying source files. It supports find, replace, cut/copy/paste and multi-level undo/redo.
- **Compiler** that follow standard ANSI-C programming language framework.
- **Assembler** that supports file-include, macro, assemble arithmetic, block comment, conditional assemble, list, map file and multiple source linking.
- **Source Level Debugger** that provides source-level debugging function on target which is embedded on the ICEeSL (In Circuit Emulator). You can explore and analyze the status, register, and the memory contents of the eSL target with the eSL/eAM IDE. With its powerful features, like multiple breakpoints, real-time modification of register contents, and disassembly, the ICEeSL becomes the indispensable partner of eSL IDE in offering a perfect development environment for eSL series microcontrollers.

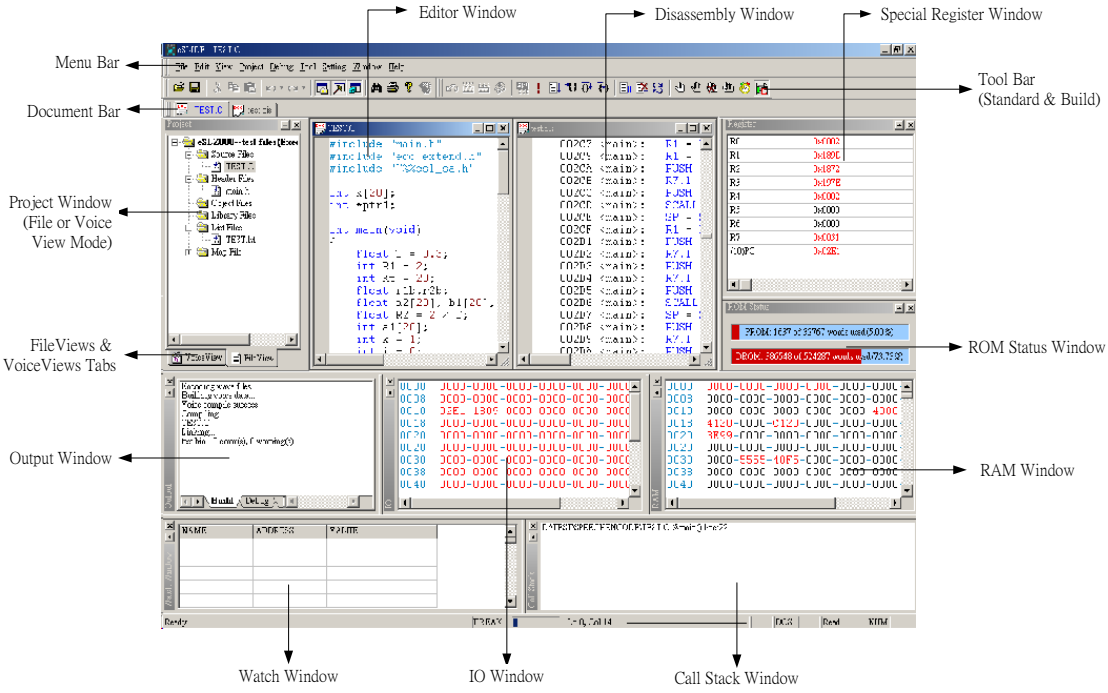
See Section 1.2.2.1 for the further discussions of File View Mode functions.

1.2.1.2 Voice View Mode

- **Project Manager** that create, save, open, and closes project. It also manages and manipulates the existing MIDI files, speech files and user data files to support instrument playback function of the eSL series sound processors.
- **Converter** that converts MIDI files, speech files and other text/binary data into voice data files for downloading into your applications.

Voice View Mode functions are further discussed in Section 1.2.2.1.

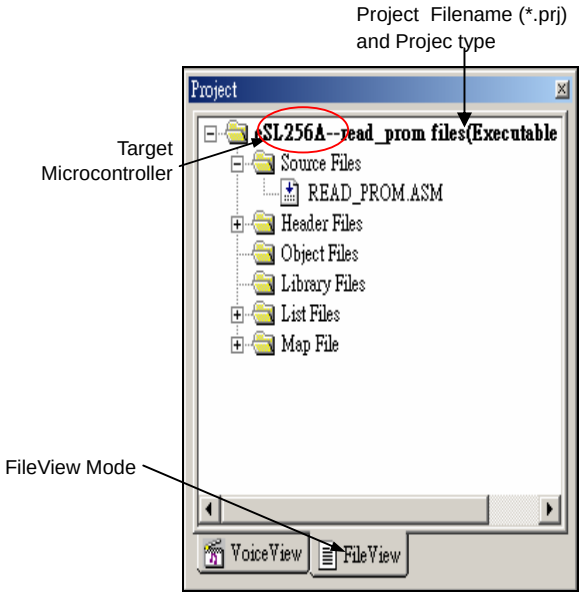
1.2.2 eSL/eAM IDE Main User Interface



eSL/eAM IDE Main Window Layout

1.2.2.1 The eSL/eAM IDE Sub-Windows

■ Project Window (File View Mode)



The **Project** window under **FileView** Mode tab holds the Source, Header, List and Map Files.

Where:

Source Files (**.asm,*.c*) – are the source assembly and c files that are added into the current project.

Header Files (*.*) – are the header files of source

Object Files (**.obj*) – are the object files that are added into the current project.

Library Files (**.a*) – are the library files that are added into the current project.

List Files *(*.lst)* – are the list files of source files.

Map Files *(*.map)* – are the file generated by the linker.

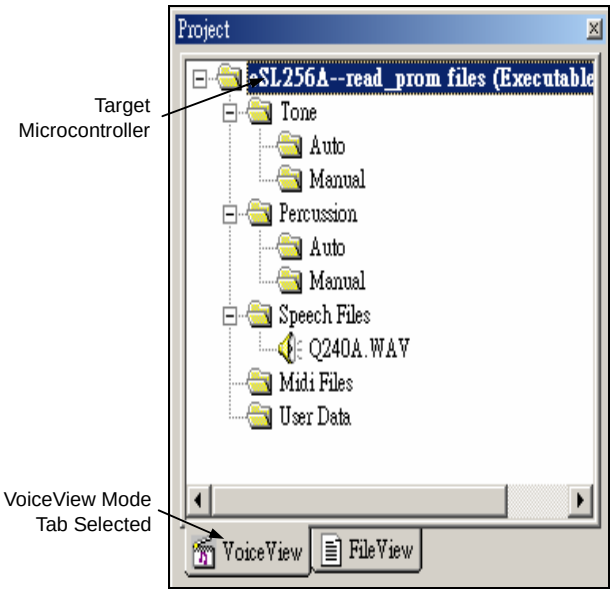
The root node of the **Project** window shows your current micro-controller, project filename, and *Project type (executable or library project)

■ **Project Type:**

Executable Project – are the project that can debug and download source data on simulator and ICEeSL

Library Project – are the project that can't debug and download source data on simulator and ICEeSL, but it can create a library file (*.a).

■ *Project Window (Voice View Mode - Internal)*



The **Project** window under **VoiceView** – **Internal** Mode tab holds the Files.

Where:

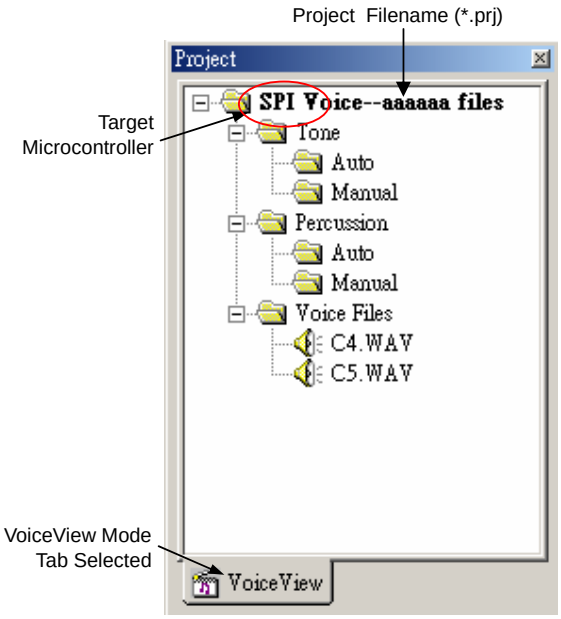
Speech Files (*.*wav,*.mp3,*.wma*) – are the speech files that are added into the current project.

Midi Files (*.*mid*) – are the Midi files of source

User Data *(*.*)* – are the user defined files of source files.

The root node of the **Project** window shows your current microcontroller and project filename.

■ *Project Window (Voice View Mode - External)*



The **Project** window under **VoiceView** – **External** Mode tab holds the Files. (only for SPI Voice Project)

Where:

Voice Files (**.wav,*.mp3,*.wma,*.mid, *.**) – are the speech, mid and user defined files that are added into the current project.

The root node of the **Project** window shows your current microcontroller and project filename.

The **Project** window under **VoiceView** Mode tab provides the **Tone**, **Percussion**, **Speech Files**, **Midi Files**, and **User Data** nodes that contain files for your utilization in developing voice projects, where:

"**Tone**" **Node** – stores the musical instru- ments defined by your MIDI files. The Tone node contains two child nodes, "Auto" and "Manual." Initially, "Auto" node is empty even if the MIDI files have been added into the voice project. Only after the **Build** or **Rebuild All** command is executed from the Project menu that the eSL/eAM IDE starts to automatically collect the instruments from MIDI file and display them under "Auto" node. On the other hand, you can manually add instruments into the voice project by clicking the **Insert Tones into Projects…** command from Project menu or clicking mouse left button at the "Manual" node under "Tone" node in this window and select the desired instruments from the resulting "Insert Tone" dialog. The selected instruments are then shown under the "Manual" node.

"**Percussion**" **Node** – contains the percussion instruments defined by your MIDI files. Like the Tone node above, the Percussion node also consisted of two child nodes, "Auto" and "Manual." It is also initially empty regardless of the presence of MIDI files in the voice project. Only after clicking the **Build** or **Rebuild All** command from the Project menu that the eSL/eAM IDE starts to automatically collect the percussion instruments for MIDI files and display them under "Auto" node. Likewise, you can manually insert percussion instruments into the voice project by executing the **Insert Percussion into Projects**... command from Project menu or clicking mouse left button at the "Manual" node under "Percussion" node in this window and select the desired instrument from its "Insert Percussion" dialog. The selected instruments are then displayed under "Manual" node.

"**Speech Files**" **Node**– hold and display the wave files of your choice. This is done by clicking the **Insert Files to Projects**... command from the **Project** menu or clicking mouse left button at the "Speech Files" node in this window. From the resulting "Insert File into Project" dialog, browse for "Speech File (**.wav,*.mp3,*.wma*)" file folder and select the one you want to insert in the voice project. The selected Speech File will show under the "Speech Files" node.

NOTE

1. *You need install microsoft media format 9 before convert into wma.*
2. *Recommend to install microsoft Media player 10,but it is not required*

"**Midi Files**" **Node**– hold and display the MIDI files of your choice. This is done by clicking the **Insert Files to Projects**... command from the **Project** menu or clicking mouse left button at the "MIDI Files" node in this window. From the resulting "Insert File into Project" dialog, browse for "Midi File *(*.mid*)" folder and select the one you want to insert in the voice project. The selected MIDI file will show under the "MIDI files "node.

NOTE

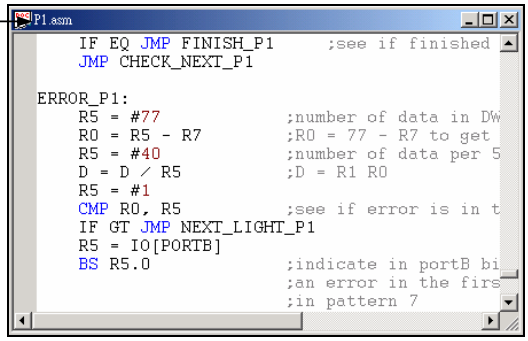
1. *The eSL/eAM IDE can only recognize the General MIDI Format 1 of the MMA specifications. Formats 0 and 2 are not supported.*
2. *Don't use Asian text font e.g., Traditional Chinese, Japenese, and extra; as midi file name..*

"**User Data**" **Node**– contains the data files *(*.tbl* and **.bin*) required by your application. To insert data files, click the **Insert Files to Project**... command from the Project menu or clicking mouse left button at the "User Data" node in this window. From the resulting **Insert File into Project** dialog, browse for the text format "Text Data File *(*.tbl*)" folder and select the one you want to insert

in the voice project. If inserting binary data, browse for the "Binary Data Files (*.*bin*)" folder from the same dialog. Press the **OK** button in the dialog to apply selection. The selected data files will be shown under the **User Data** node.

■ Editor Window

Current file being edited


P1.asm
IF EQ JMP FINISH_P1 ;see if finished
JMP CHECK_NEXT_P1
ERROR_P1:
R5 = #77 ;number of data in DW
R0 = R5 - R7 ;R0 = 77 - R7 to get
R5 = #40 ;number of data per 5
D = D / R5 ;D = R1 R0
R5 = #1
CMP R0, R5 ;see if error is in t
IF GT JMP NEXT_LIGHT_P1
R5 = IO[PORTB]
BS R5.0 ;indicate in portB bi
;an error in the firs
;in pattern 7

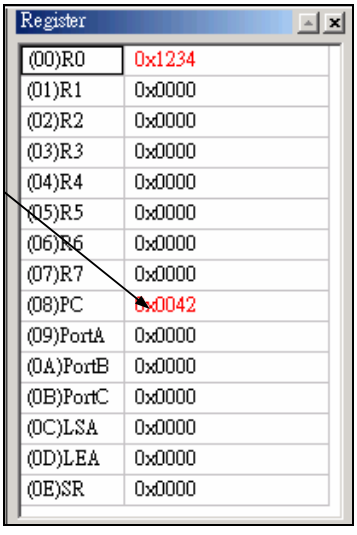
The eSL/eAM IDE Editor is a multi- windowed editing tool for creating, viewing, and modifying source files.

The eSL/eAM IDE Editor major features are –

- Colored syntax highlighting
- Unlimited file size
- Multiple files can be opened and displayed at the same time
- Insert and overstrike modes for editing
- Unlimited Undo/Redo
- Auto indentation
- Clipboard support with find and replace
- Drag and drop text manipulation

■ Special Register Window

When value changes, it is shown in red



The **Special Register** window provides the control register, a program counter, and general register (R0-R7).

To update register values, click on the existing value and key in the new value.

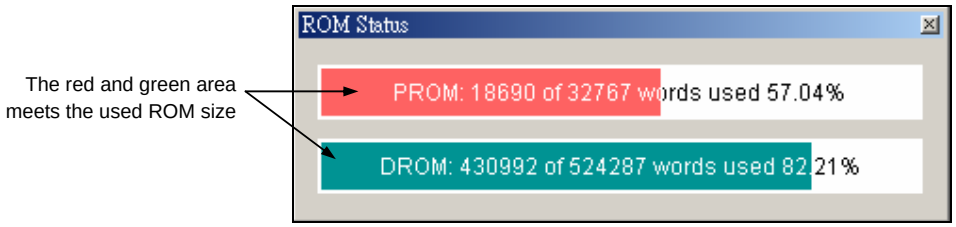
NOTE

1 *Only values from 0 to 9 or A to F are recognized when changing register in hexadecimal format. Likewise, only 0 & 1 are recognized when changing registers in binary format.*

2. *Modified registers are automatically downloaded to the hardware.*

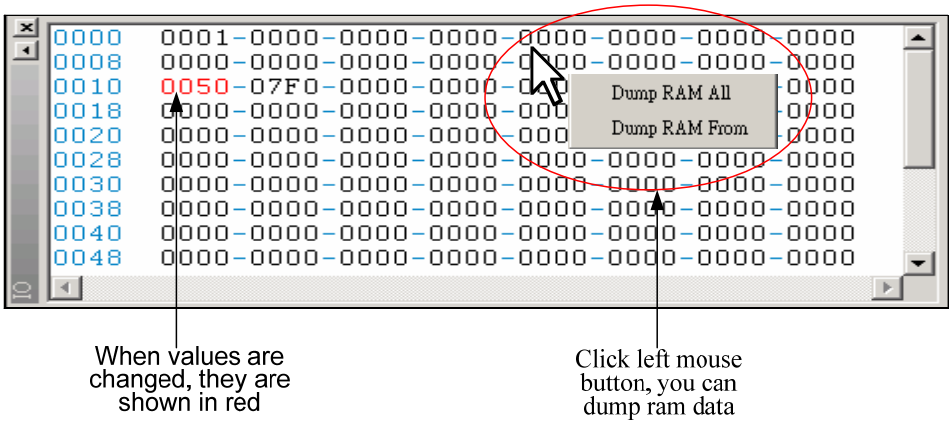
To toggle between hex (0x) and binary (0b) register values, click right mouse button while pointing on the particular register value.

■ ROM Status Window

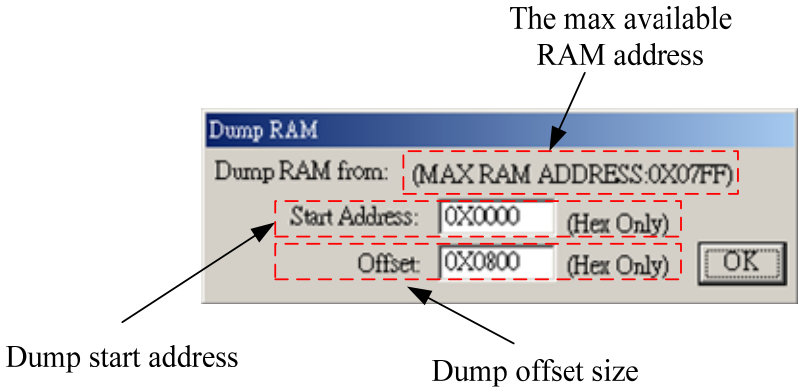

The red and green area
meets the used ROM size
ROM Status
PROM: 18690 of 32767 words used 57.04%
DROM: 430992 of 524287 words used 82.21%

ROM Status window show how many Program ROM and Data Rom Size used by user's source code and voice data. The red and green section meets the used size.

■ RAM Window



RAM window provides the updated contents of RAM in the same way as in updating the contents of the special registers. The address format (hex) is in left column.The RAM window allows user click right mouse button to pop-up a dump menu. The dump menu save total RAM data at *.ram file and locate at active project floder.



Dump DRAM From Dialog

Dump RAM All: dump and save ram datas from address 0 to the last address.
Dump RAM From: dump and save ram datas which the address range specified by user. Example:

Start address = 0x100
Offset = 0x050
End address = 0x150

*meets you want dump ram data from RAM address 0x100, offset 0x50, end address is 0x150 and total count is 0x50.

NOTE

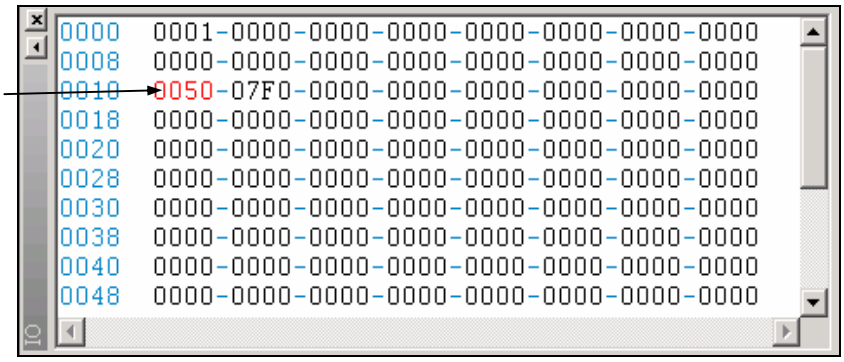
1. Start address can't over max address.

2. Start address + offset = end address can't over max address

3. offset aloes meets total count

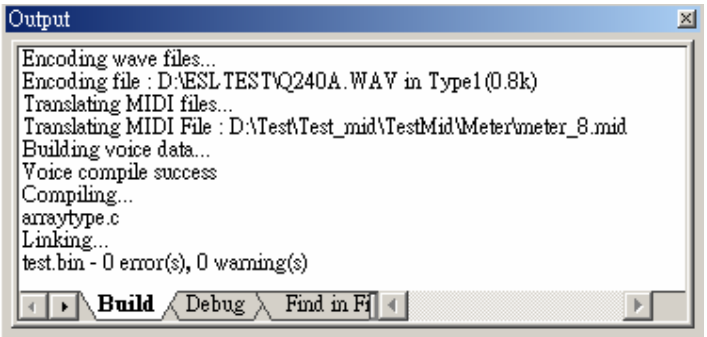
■ IO Window

When values are changed, they are shown in red



IO window provides the updated contents of IO in the same way as in updating the contents of the special registers. The address format (hex) is in left column.

■ Output Window



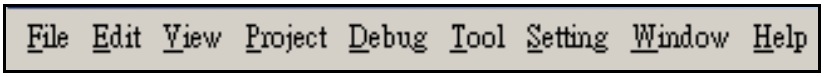
The **Output** window displays messages indicating results of project compiling just performed, such as assembler, linker, trace log history, and debugging, including their respective error messages. The window consisted of three tab sub-windows, namely**; Build**, **Debug**, and **Find in Files**, where**:**

Build – displays assembler/linker related messages, trace logs, and error messages. Double click on the error message to link to the corresponding program text line in the Editor window where the source of error occurs.

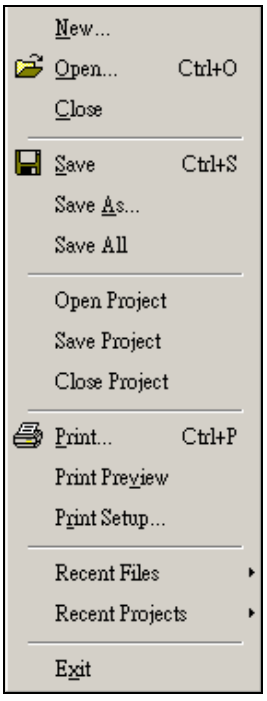
Debug – displays debugging related messages and their corresponding error messages.

Find in Files – allows you to find a like string (selected from an active file) from other active or inactive files in your folder. Lines containing the like string will display on the Output window complete with its source filename and directory.

1.2.2.2 eSL/eAM IDE Menu Bar and its Commands

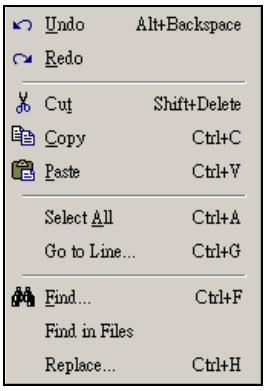


■ *File Menu*



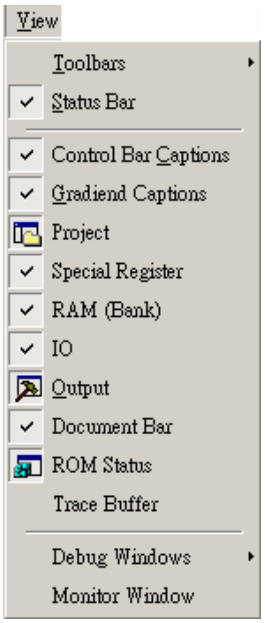
New…	Create a new project or source file
Open…	Open an existing document or project
Close	Close the active document or project
Save	Save current active document
Save As	Save current active document under new filename
Save All	Save all current active documents
Open/Save/Close Project	Open/Save/Close the active project
Print	Print the active document
Preview	Preview the printed format of the active document
Setup	Define printer settings
Recent Files	View the record of the recently closed file
Recent Project	View the record of the recently closed project
Exit	Exit from eSL/eAM IDE Program

Edit Menu

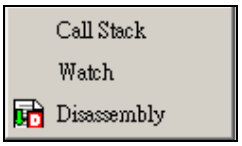


Undo	Cancel the last edit action
Redo	Repeat the last edit action
Cut/Copy/Paste	Same as standard clipboard function
Select All	Select all contents of the active window
Go to Line…	Move cursor to the defined line number within the active window
Find	Find the defined strings in the active window
Find in Files	Find the defined strings in one or more files window
Replace…	Same as standard “find and replace” editing functions

View Menu



Toolbars	View/hide Standard or Build toolbar
Status Bar	View/hide ICE modes, R/W flag, test file type (DOS/MAC/ UNIX), keyboard status, etc.
Control Bar Captions	View/hide all captions for Project, RAM, and Output windows
Project	View/hide Project window
Special Register	View/hide Special Register window
IO	View/hide IO Register window
RAM	View/hide RAM window
Output	View/hide Output window
Document Bar	View/hide document Bar
ROM Status	View/hide ROM Status window
Trace Buffer	View/hide Trace Buffer
Debug Windows	View/hide Debug Windows:



1.Call Stack Window

2.Watch Window

3.Disassembly Window

Monitor Window	View/Hide Monitor window

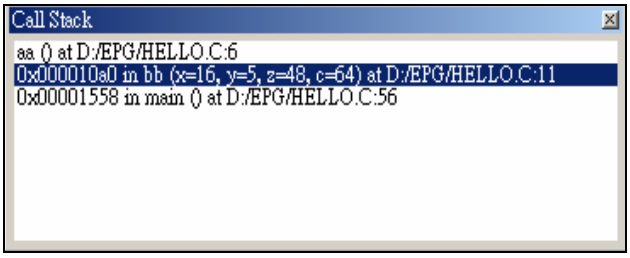
Debugr Window: View/Hide **Call Stack/Watch/Disassembly** window

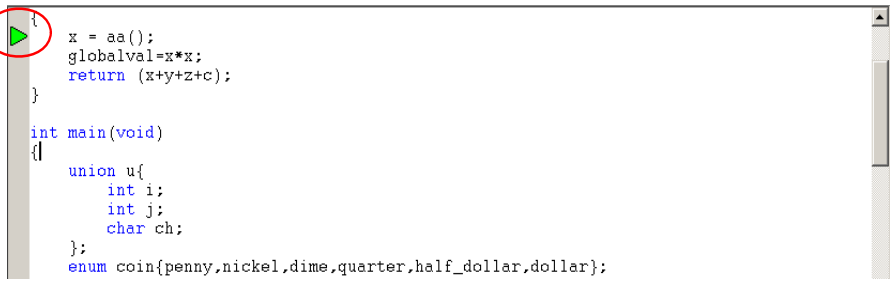
Call Stack Window: The Call Stack window shows a list of all active Procedure Calls. *Active procedure calls* are the procedures in the application that were started but not completed. The Call Stack window helps you trace the operation of an application as it executes a series of nested procedures. For example, an event procedure can call a second procedure, which can call a third procedure — all before the event procedure that started this chain is completed. Such nested procedure calls can be difficult to follow and can complicate the debugging process. You can double click any expression in the Call Stack window and then IDE will show an arrow to pinpoint at the corresponding source code.

Note

Call Stack window only use at C Project

■ *Call Stack Window*





Show green arrow at corresponding source code

Watch Window: The Watch window lets you view and modify program variables and lists the current function call nesting. The contents of the Watch Window are automatically updated whenever program execution stops. Note, watch window for asm project only can watch the symbols defined as .DW, .DS, .EQU, Level and RAM data. Note, EQU Symbol no address information, .DS symbol only shows the first address and data.For example:

RamReserve .DS 1 ← *.DS Symbol*

EquValue .EQU 10 ← *.EQU Symbol*

RomReserve .DW 0x10 ← *.DW Symbol*

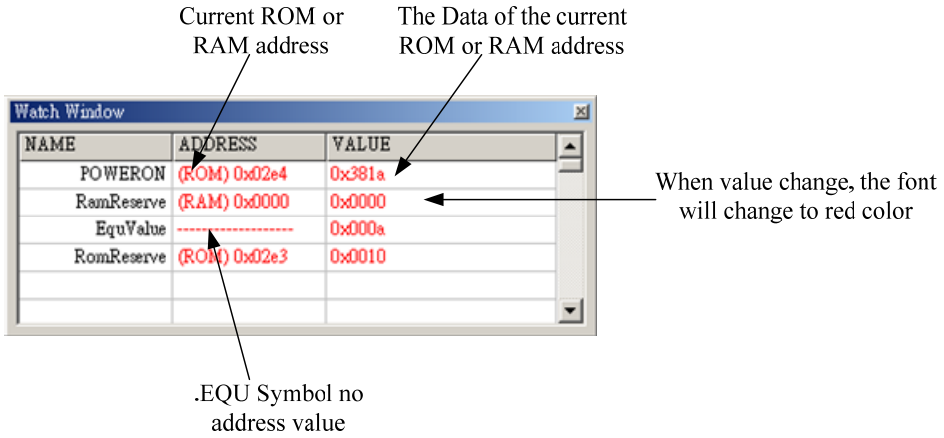
POWERON: ← *Label Symbol*

RAM data format: [expression]. The Expression only can full into decimal number, hexadecimal hexcital number and some EQU symbol,like:

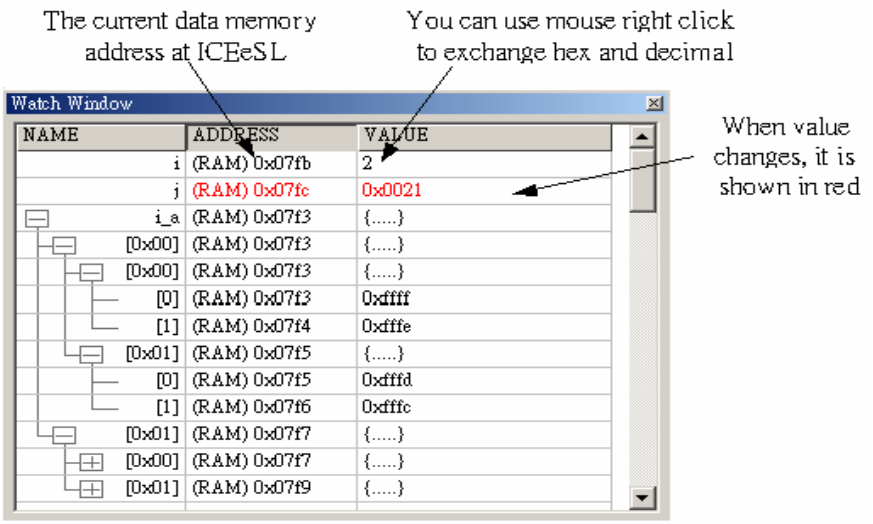
RAMADDRESS .EQU 50

[1] [0x1234] [RAMADDRESS]

■ Watch Window for Asm Project

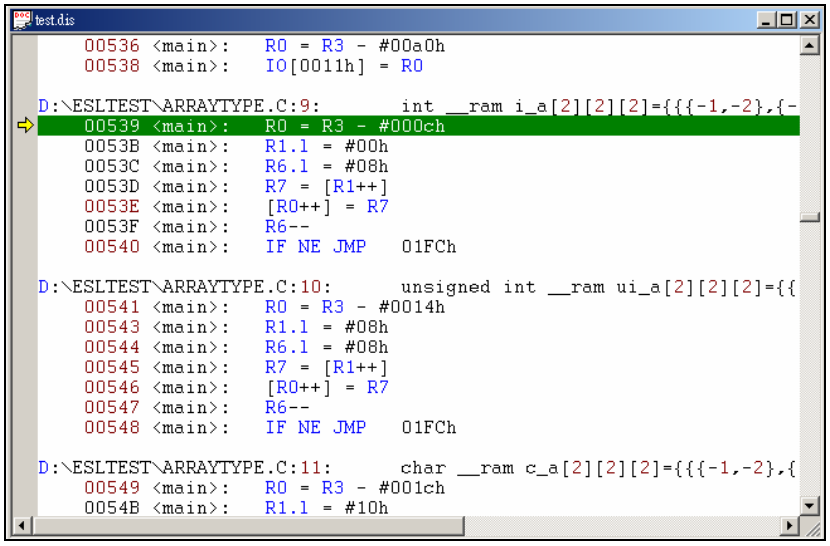


■ Watch Window for C Project


The current data memory address at ICEeSL
You can use mouse right click to exchange hex and decimal
When value changes, it is shown in red
Watch Window
NAME
ADDRESS
VALUE
i (RAM) 0x07fb 2
j (RAM) 0x07fc 0x0021
i_a (RAM) 0x07f3 {.....}
[0x00] (RAM) 0x07f3 {.....}
[0x00] (RAM) 0x07f3 {.....}
[0] (RAM) 0x07f3 0xffff
[1] (RAM) 0x07f4 0xfffe
[0x01] (RAM) 0x07f5 {.....}
[0] (RAM) 0x07f5 0xfffd
[1] (RAM) 0x07f6 0xfffc
[0x01] (RAM) 0x07f7 {.....}
[0x00] (RAM) 0x07f7 {.....}
[0x01] (RAM) 0x07f9 {.....}

Disassembly Window: The Disassembly window shows your target program as assembly code. The highlighted instruction shown indicates the Active procedure. You also can select the Disassembly Window as the active window to debug your target program, but take note that eSL/eAM IDE does not allow user to set breakpoint in the Disassembly window.

■ Disassembly Window

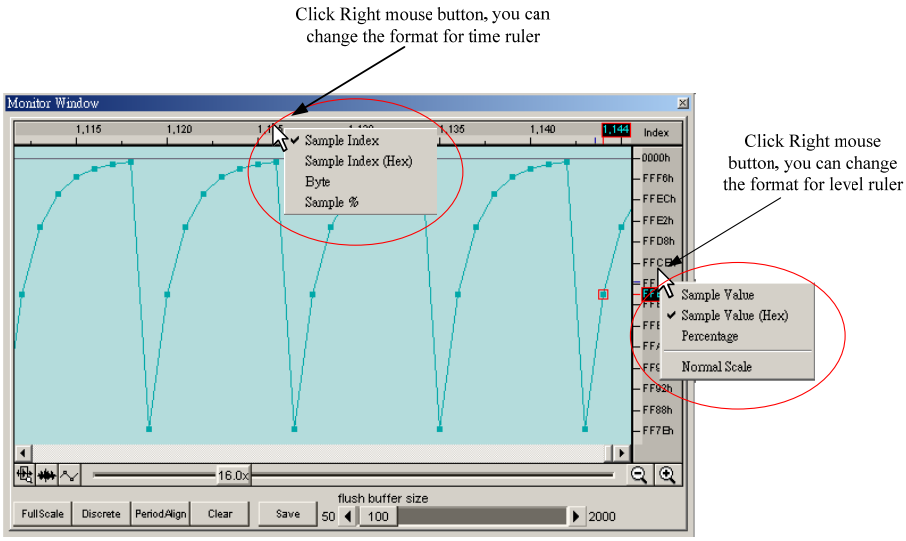


Monitor Window: The Monitor window show data which get from IO[0x7D]. Before use this window, you must enable monitor data flag at [menu]→ [Debug]→[Enable Monitor Data] and connect to ICEeSL.

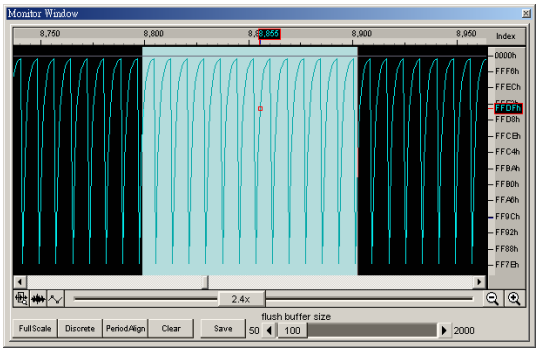
Note

The limit of sample rate for monitor data is 8K (samples/per second)

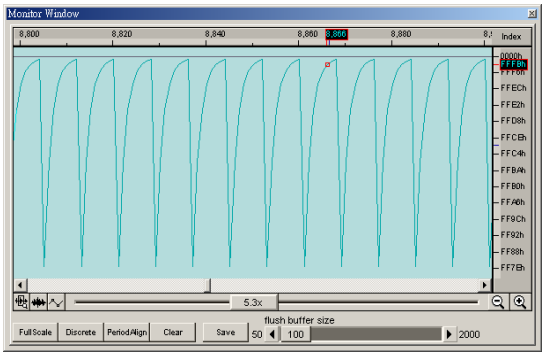
■ *Monitor Window*



Zoom Selection

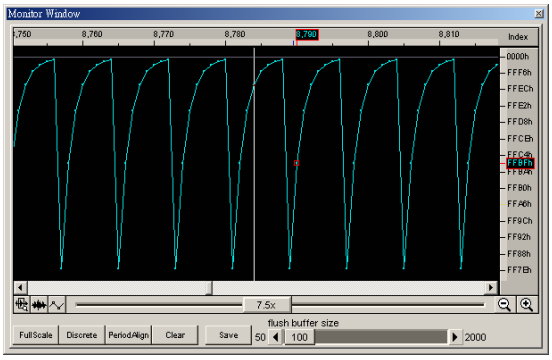


Before Zoom Selection

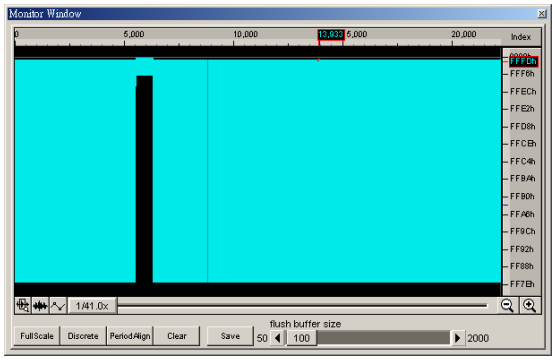


After Zoom Seletion

Full Zoom-Out

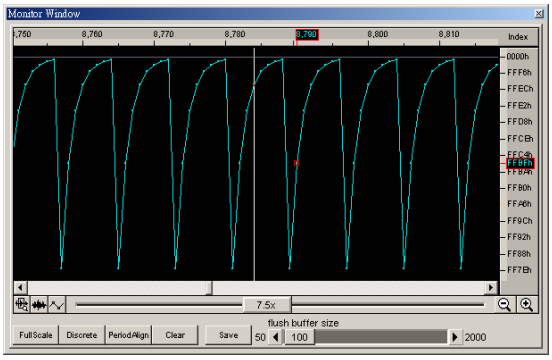


Before Full Zoom-Out

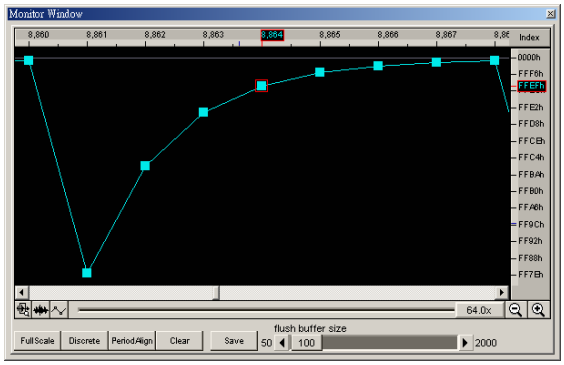


After Full Zoom-Out

Full Zoom-Iin

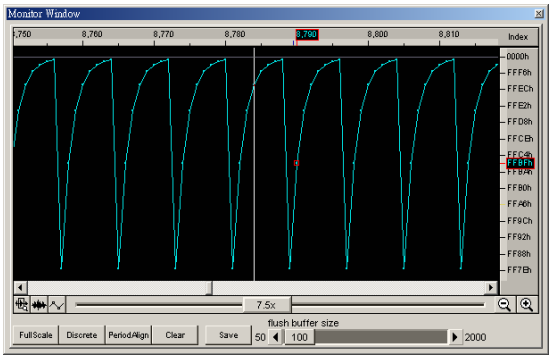


Before Full Zoom-In

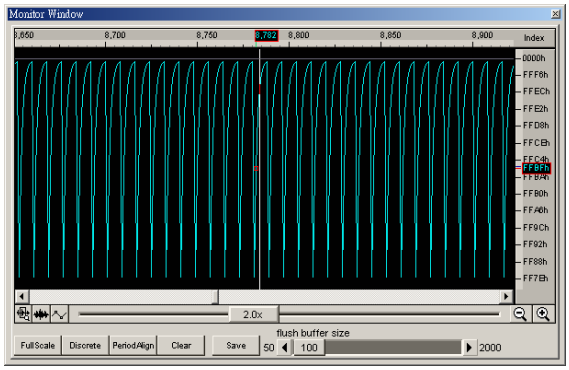


After Full Zoom-In

Zoom-Out

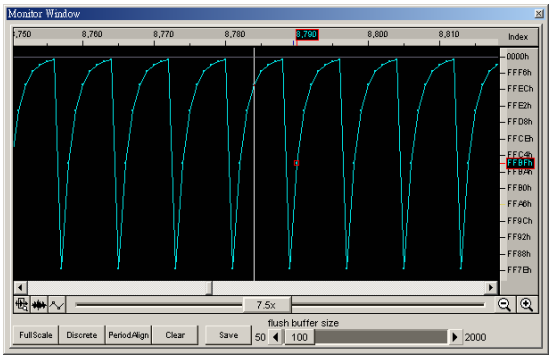


Before Zoom-Out

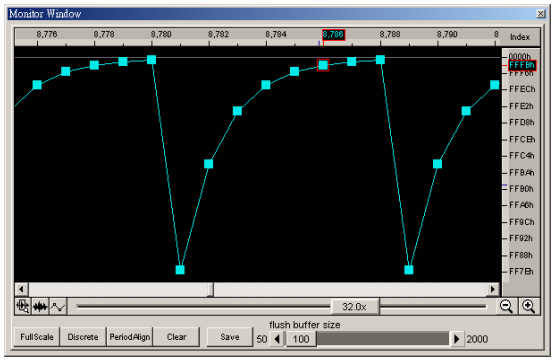


After Zoom-Out

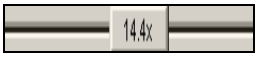
Zoom-In

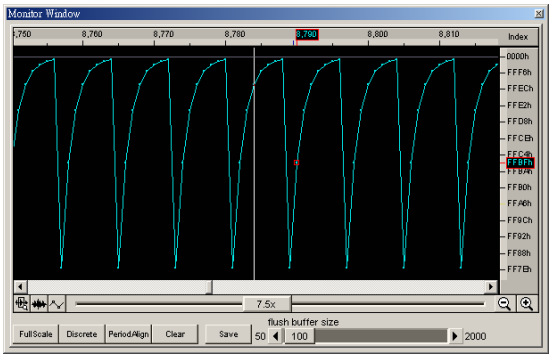


Before Zoom-In

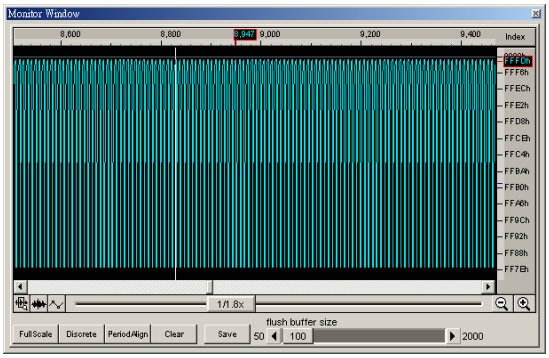


After Zoom-In

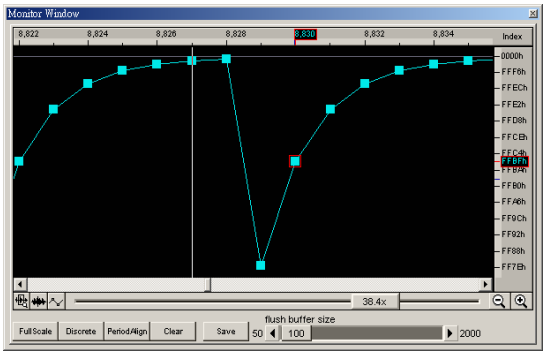
 Zoom Bar



Before drag zoom bar

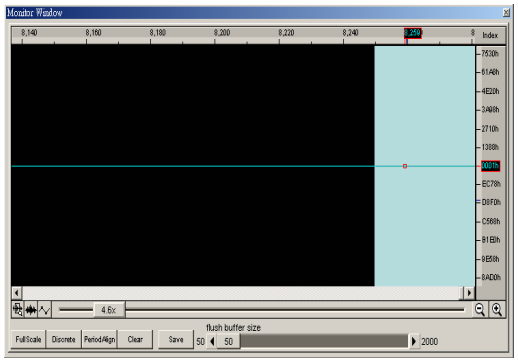


After zooming in

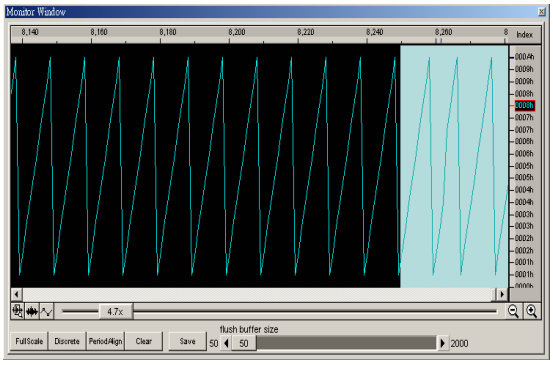


After zooming out

Full Scale: Set all samples full scale

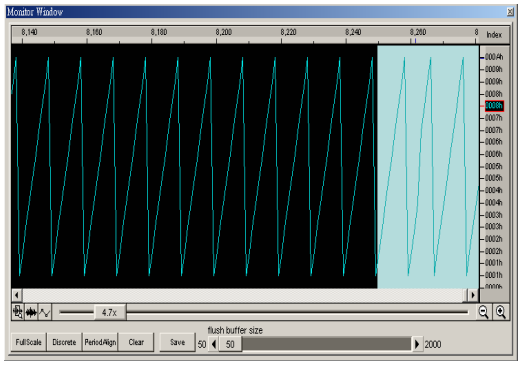


Before Full Scale

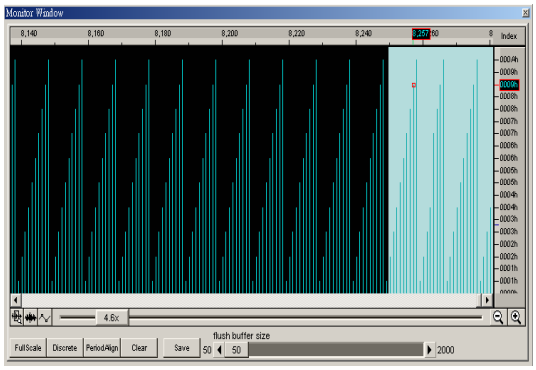


After Full Scale

Discrete: Set all continuous samples discrete.



Before Discrete



After Discrete

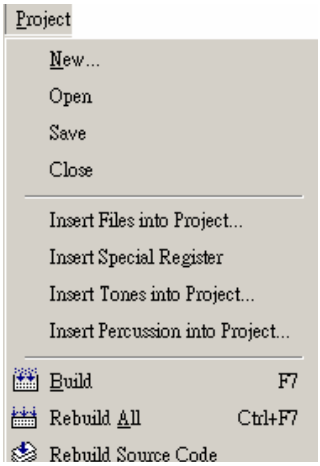
Period Align: Calculate frequency of waves. Monitor window will change wave band when the period change.

Clear: Clear All Samples which show at monitor window.

Save: Save all samples which user select (blue area), but if user doesn't select save area, monitor window will save all samples.

Flush buffer size bar: How many samples flush the monitor window. (Samples / per time)

■ Project Menu



New… Create a new project

Open Open an existing project

Save Save the active project together with all related data

Close Close the active Project window

Insert Files to Project… Insert program source files into project

Insert Special Register Insert Special register into Special register window

Insert Tones into Project… Insert music tones into project

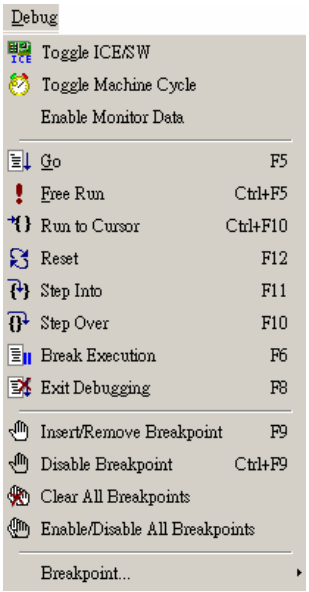
Insert Percussion into Project… Insert percussion into project

Build Compile modified files only

Rebuild All Compile all source files and all voice file regardless of their recent change status

Rebuild Source Code Compile all source files regardless of their recent change status

■ Debug Menu



Toggle ICE/SW Switch to “ICE or Simulator” to debug program by simulator or ICE

Toggle Machine Cycle Enable/Disable Get Machine Cycle count

Enable Monitor Data Enable/Disable Monitor I/O Address Data

Go Run program starting from the current program counter until breakpoints are hit

Free Run Run program starting from the current program counter until Break Execution command (stop debugging) occurs

Run to cursor Run program starting from the current program counter up to the location where the cursor is anchored (applies to ICE debug mode only)

Reset Perform hardware reset (register contents are displayed with initial values)

Step Into	Execute instructions step-by -step (with register contents updated simultaneously). Note, in c project, step into always clear trace buffer.
Step Over	Execute instructions as in Step Into except for Call instruction, which is executed as in Go command above. Note, in c project, step over always clear trace buffer.
Break Execution	Stop running program without ICE reset (program will resume running from the location where it was last stopped)
Exit Debugging	Set debugger in normal (editable) mode and ICE reset is carried out (Debugger in debugging mode sets the Editor window to read only)
Insert/Remove Breakpoint	Set or reset a breakpoint
Disable Breakpoint	Disable a breakpoint
Clear All Breakpoints	Clear all active breakpoints
Enable/Disable All Breakpoints	Enable or Disable all breakpoints
Breakpoint…	Set ROM and Hardware breakpoint (under ROM and Hardware Breakpoint Setting dialog)

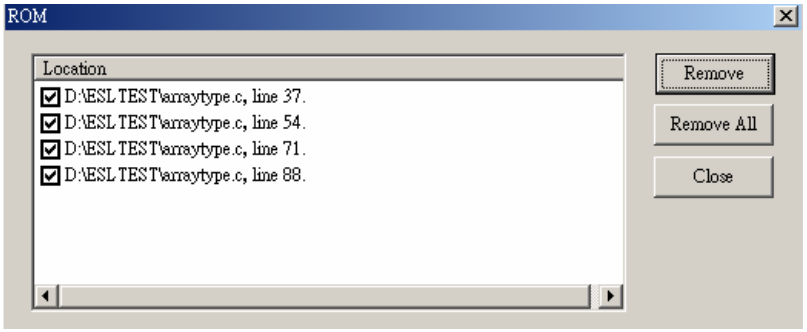
Toggle ICE/SW: Switch to "ICE or Simulator" to debug program by simulator or ICE. The different between ICE and Simulator are:

	ICE	Simulator
Download		
Download PROM	Enable	Enable
Download DROM	Enable	Disable
Download SPI	Enable	Disable
Debug function		
Step Into/Ouver	Enable	Enable
Go/Go Cursor/Free Run	Enable	Enable
Break/Stop/Reset	Emable	Enable
Rom Break point	Enable	Enable
Hardware Break point	Enable	Disable
Get Machine Cycle Count	Enable	Enable
Monitor Window	Enable	Disable
Call Stack Window	Enable	Enable
Watch Window	Enable	Enable
Disassembly Window	Enable	Enable
Other		
Play Midi/Speech	Enable	Disable
Access DROM by instruction	Enable	Disable
Self Test	Enable	Disable

Toggle Machine Cycle: Enable/Disable Get Machine Cycle count. The valid range of machine cycle is form 0x00 to 0xFFFFFF (16777215). If machine cycle over this range, eSL/eAM IDE will show overflow message at output window.

ROM Breakpoint Dialog: ROM breakpoint can set at any address of the Program ROM. At this Dialog, you can check all ROM breakpoints in project, remove one or remove all breakpoint. In addition, you can click checkbox to disable ROM breakpoint.

ROM Breakpoint Dialog

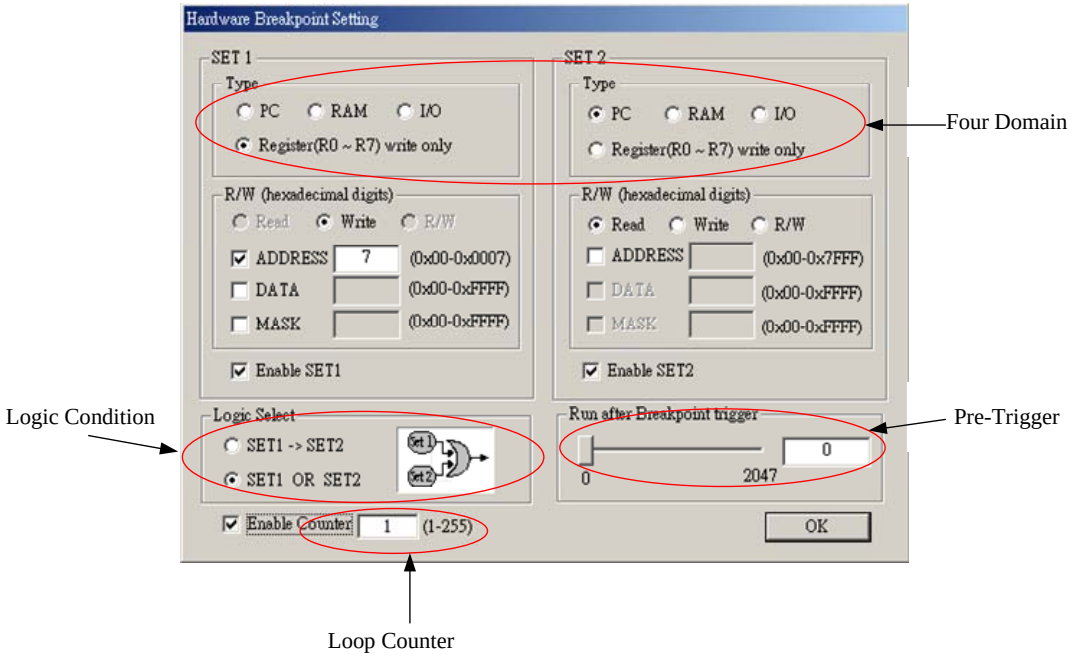


Hardware Breakpoints Dialog: The breakpoint mechanism has a unique breakpoint system that supports software and hardware breakpoint. The system has a limited number of hardware breakpoint and unlimited software breakpoint setting. The four domain and two set hardware breakpoints are available. In addition the breakpoint system supports logical condition (set1 OR set2 / set1 sequential to set2) and loop counter function (from 1 to 255) select and trace buffer pre-trigger from 0 to 2k.

NOTE

1. *Address, Data and Mask value are hexadecimal digits, others decimal digits.*
2. *.If you select logic "set1 sequential to set2", SET1 and SET2 will be enabled.*
3. *.If Address, Data or Mask value is NULL or over range, IDE will show a warning message dialog to alert you.*
4. *.If you select DATA item, IDE will set ADDRESS enabled. In the same way, if you select MASK item, IDE will set ADDRESS and DATA enabled*
5. *Hardware Breakpoints is only enabled at Debugging mode.*

Hardware Breakpoints Dialog (please refer to Appendix C)



PC counter break (read/write)

You can set an immobile PC value to trigger break.

PC range from 0x0000 to 0x7FFF

RAM break (read/write)

The data memory breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, in addition every mode support Data memory Read, Data memory Write or Data memory Read or Write. Data breakpoints will work in internal data memory.

Data memory address from 0x000 to 0x1FFF for eSLZ000 platform, others 0x07FF

Data memory data from 0x0000 to 0xFFFF

Mask data from 0x0000 to 0xFFFF

I/O break (read/write)

The I/O breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, in addition every mode support Data Read, Data
Write, Data Read or Write.
I/O address from 0x00 to 0x7F
I/O data from 0x0000 to 0xFFFF
Mask data from 0x0000 to 0xFFFF

Register break (R0~R7) (write only)

The register breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, but in register domain only support address write, Data Write.
Register address from 0x0 to 0x7
Register data from 0x0000 to 0xFFFF
Mask data from 0x0000 to 0xFFFF

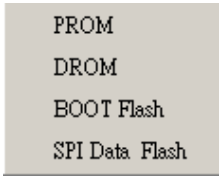
■ *Tool Menu*

Generate Mask File — Generate a mask program file (*.msk) rom the project.

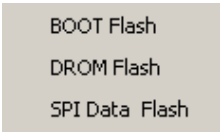
Play MIDI/Speech — Open Play Dialog. User can play midi and speech throw ICEeSL by this Dialog.

Open EzWave — Open eSL EzWave

ICE Download — Allow user download PROM,DROM, Boot Flash, SPI Flash data form current project builded or other selected binary data into ICEeSL



EMF Download — Allow user download Boot Flash, DROM Flash data and SPI data flash into EMF



ICE Download

PROM: Download Data to ICEeSL PROM
DROM: Download and auto verify data to ICEeSL DROM
Boot Flash: Download data to ICEeSL SPI Boot Flash
SPI Data Flash: Download data to ICEeSL SPI Data Flash

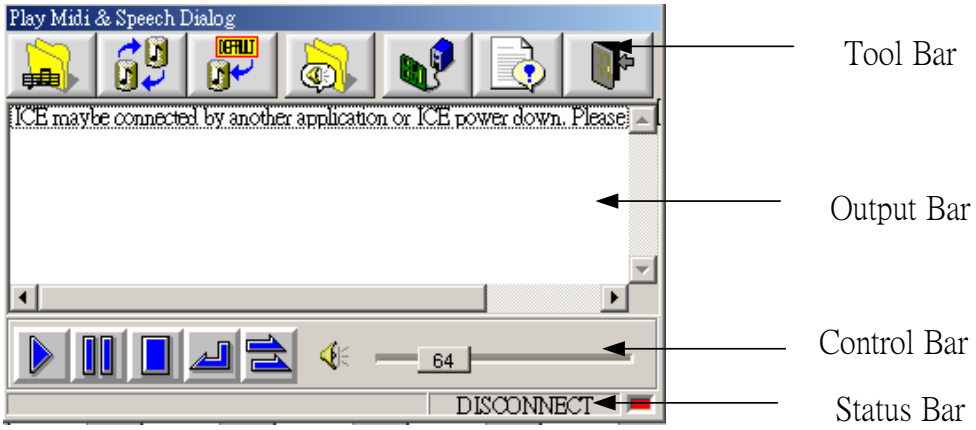
EMF Download

Boot Flash: Download data to EMF Boot Flash

DROM Flash: Download data to EMF DROM Flash

SPI Data Flash: Download data to ICEeSL SPI Data Flash

Play Midi and Speech Dialog (please refer to Appendix B)



Tool Bar:

Open and build midi file (user must select form type fisrt)

Open and build speech (user must select coding type first)

Connect ICE

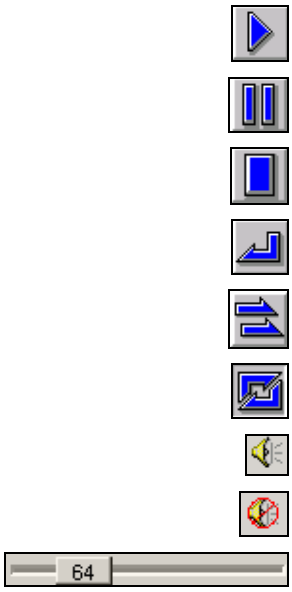
Change Midi tone library (Instrument And Percussion)

Load IDE support default Midi tone library file

Info (output active Midi tone library file, builded midi and speech file)

Exit

Control Bar:



Play midi or speech button

Pause midi or speech playing button

Stop midi or speech playing button

Restart(Reset) playing button

No Repeat playing midi or speech button

Repeat playing midi or speech button

Sound on button

Sound off button

Volume slider bar

Output Bar: The Output bar displays messages indicating results of midi or speech compiling just performed, such as connection, midi or speech file information, and change *.inp (Instrument And Percussion) data, including their respective error messages.

Status Bar: Show Status

Connect Status: ICE Connected

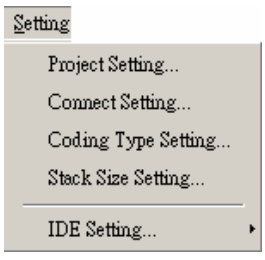
Disconnect Status: ICE Disconnect

Play Status: Playing Midi or Speech file

Pause Status: Pause Playing Midi or Speech file

Stop Status: Stop Playing Midi or Speech file

■ *Setting Menu*



Project Setting Define compiler (assembler), linker, customize and directory option.

Connect Setting Define printer port connection with ICE (default is 378H)

Coding Type Setting Define speech coding type

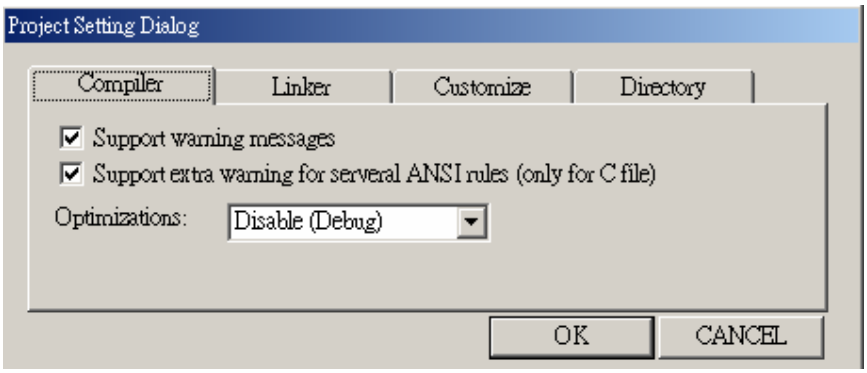
Stack Size Setting Define stack size

IDE Setting… **Tab…** Define tab size for Editor & output windows

Font…Define font for Editor & Output windows

Project Setting: Define compiler (assembler), linker, customize and directory option.

Compiler Option Dialog

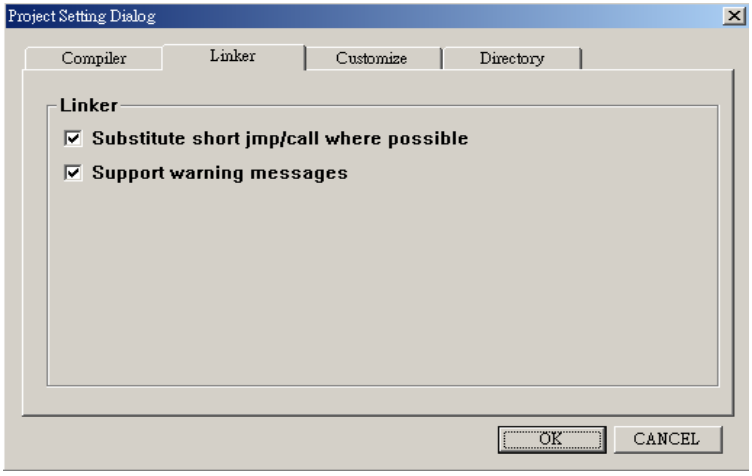


Support warning messages: Support warning message when compile or assemble project

Support extra warning for several ANSI rules: Support extra warning message for several ANSI rules when compile C file. This option only work at C file.

Optimization: Support debug information if select debug mode, opposite, Release mode doesn't have debug information. For this reason, if you want to debug source code, you must select disable (debug mode)

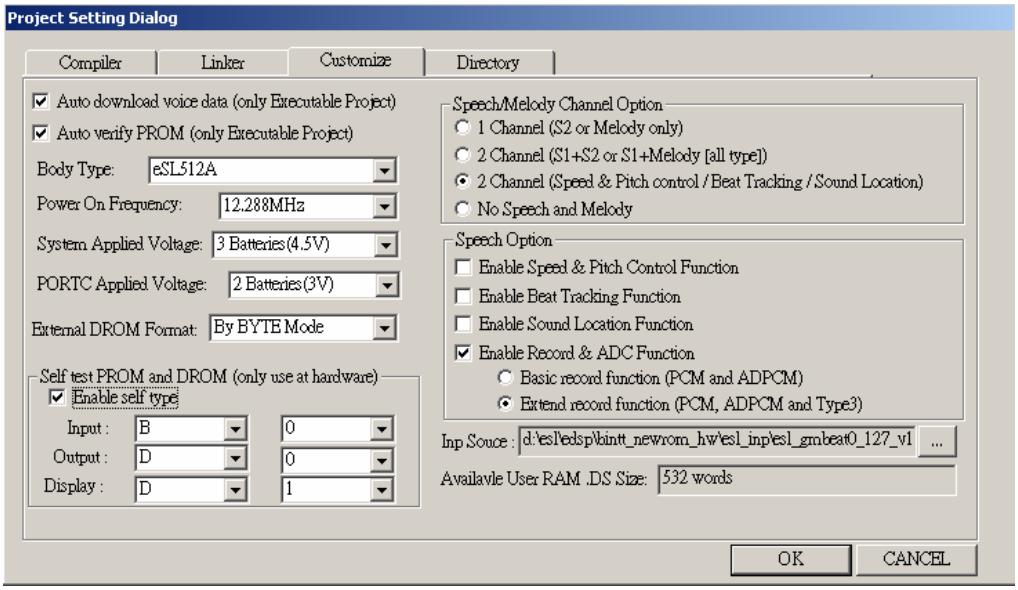
Linker Option Dialog



Substitute short jump/call where possible: Support jump/call instruction optimization

Support warning messages: Support warning message when link project

Customize Option Dialog



Auto download voice project data: eSL/eAM IDE will auto download voice data into DROM when user starts debugging source code. This option enable when eSL/eAM IDE connect ICEesL and only support executable project (i.e. only executable project can debug source code).

Auto verify PROM data: eSL/eAM IDE will verify PROM when compile or assemble source code.

Body Type: IDE allow user reset body type, when project opened.

Power On Frequency: eSL/eAM IDE allow user reset Power On frequency when project opened. Frequency options are 8.192MHz, 12.288MHz, 16.384MHz, 18.022MHz and don't care.

System Applied Vlotage: IDE allow user selet the voltage for system.If user selects the option (4.5V), the frequency for eSL and eAM serial chip are 12.288MHz, 16.384MHz, 18.022MHz and don't care. If user selects the option (3V), the frequency for eSL serial chip are 8.192MHz, 12.288MHz and don't care, for eAM serial chip are 12.288MHz and don't care.

PORTC Applied Voltage: IDE allow user select the voltage of PORTC.If user selects the option (4.5V). The IDE prohibit the IO[0x64] read/write for total instruction and display the error in the output window.

External DROM Format: IDE allow user selet the external data format type. Note, if external rom device is SPI Flash, must select **BY BYTE Mode**.

Selftest PROM and DROM: Enable or disable selftest PROM and DROM. When user select disable, the eSL/eAM IDE will not fill dummy data (0xFF) to

the maximum address and only fill the address which user used to binary file. User can select input, output and display pin. (*please refer to Appendix D*)

> **Note**
> *This option only enable at ICE mode, no support at Simulator mode*.

Inp Source: User can indicate instrument and percussion library file through this brower.
Available User RAM .DS Size: show how mamy RAMs can be used for user.
Enable Record Option Function: When users enable record option, the record function will be activated. This option only support at eSL serial body.
Enable Speed/Pitch Control Function: When users enable speed/pitch control, the speed/pitch control will be activated. Besides, when users enable speed/pitch control and record option function at the same time, real time pitch control function from the peripheral device (A/D converter) will be activated. This option only support at eSL serial body (eSL128SA, eSL256SA, eSL512SA, eSL128A, eSL256A, eSL512A, eSL032A) and enable when select speech/melody option 3.
Enable Tempo Detection Function: When users enable tempo detection, tempo detection function from the peripheral device (A/D converter) will be activated. This option only support at eSL serial body (eSL128A, eSL256A, eSL512A, eSL032A) and enable when select speech/melody option 3.
Enable Sound Location Function: When users enable sound location, the sound location function will be activated. This option only support at eSL serial body (eSL128A, eSL256A, eSL512A, eSL032A) and enable when select speech/melody option 3.

Speech/Melody Channel Option: IDE support user three kinds of speech memory allocation option by different chip serial (eSL and eAM serial chip) selected by users. The more memory users can use, the more limit in using speech algorithm. The memory allocation is as follow:
eSL Serial Chip:
(1) 1 Channel (S2 or Melody only): Only support channel 2 can be used. The eSL/eAM IDE will reserve max usable RAM size for user. If users select this option, the memory which user can use is 1008 words (address 0~ address 1007). Speech algorithm type1, type2, type3, type4, type5 and type6 can be selected.

(2) 2 Channel (Speed && Pitch control / Beat Tracking / Sound Location): Support 2 channels can be used. The eSL/eAM IDE will reserve mid usable RAM size for user. If users select this option, the memory which user can use is at last 30 words (address 0 ~ address 29). The speech algorithm can be used is the same as next Table of option (3).

(3) 2 Channel (S1+S2 or S1+Melody [all type]): Support 2 channels can be used. The eSL/eAM IDE will reserve min usable RAM size for user. If users select this option, the memory which user can use is 307 words (address 0~ address 306). The speech algorithm can be used is listed at next table.

Play condition	Play 1channel speech		Play 2channel speech(at the same time)
	Channel1	Channel2	
Support algorithm	type1, type2, type3, type4, type5, type6	type1, type2, type3, type4, type5, type6, 16channel melody	type1+type1, type1+type2, type1+type3, type1+type4, type1+type5, type2+type2, type2+type3, type2+type4, type2+type5, type3+type3, type3+type4, type3+type5, type4+type4, type4+type5, type5+type5, type5+type6 type6+type6 8channel melody+type1, 8channel melody+type2, 8channel melody+type3, 8channel melody+type4, 8channel melody+type5, 8channel melody+type6

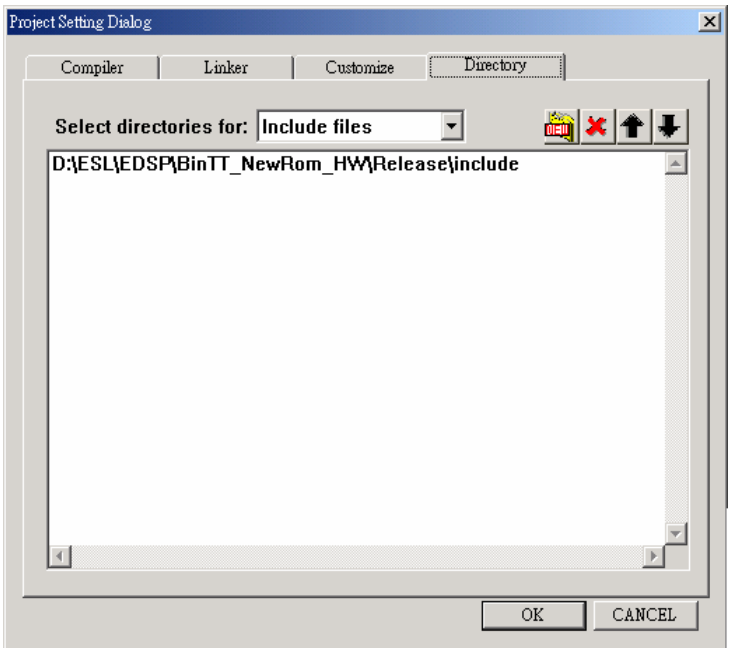
eAM Serial Chip:

(1) Melody Only: Only melody playing can be used. The eSL/eAM IDE will reserve max usable RAM size for user. If users select this option, the memory which user can use is 1051 words (address 0~ address 1050).

(2) 2 Speech or Melody: It can support maximum 2 speeches or melody. The eSL/eAM IDE will reserve available RAM size for user. If users select this option, the memory which user can use is 783 words (address 0~ address 782). The speech algorithm can support type 5 and type 6.

(3) more than 2 Speech or Melody: It can support maximum 4 speeches or melody. The eSL/eAM IDE will reserve available RAM size for user. If users select this option, the memory which user can use is 755 words (address 0~ address 754). The speech algorithm can support type 5 and type 6.

Directory Option Dialog



Directory Option Dialog: supports user specify directories to search for header files and libraries.

Include files: Add the directory *dir* to the head of the list of directories to be searched for header files. This can be used to override a system header file, substituting your own version, since these directories are searched before the system header file directories.

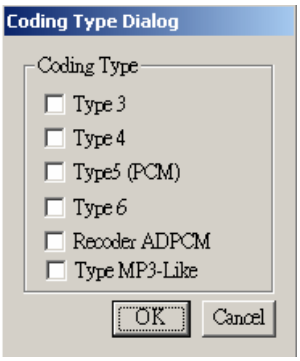
Library files: The linker searches a standard list of directories for the library, which is actually a file named *library*. The linker then uses these files as if it had been specified precisely by name.

Connect Setting: Select which printer port is connected to ICEeSL.

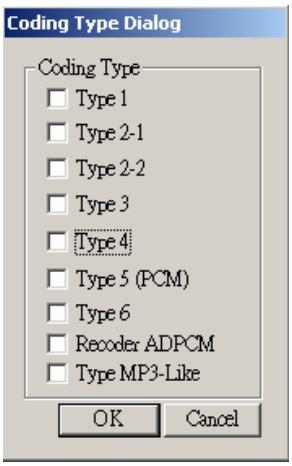
Connect Dialogue.

Coding Type Setting: Select speech coding type.

eSL032, eSL128, eSL256, eSL512, eSL128S, eSL256S and eSL512S include Type 3, Type 4, Type 5, Type 6, Recorder ADPCM, and Type MP3-Like.

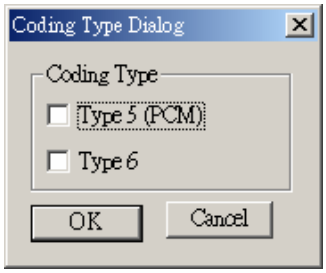


eSLZ000, eSL032A, eSL128A, eSL256A, eSL512A, eSL128SA, eSL256SA and eSL512SA include Type1, Type 2-1 Type 2-2, Type 3, Type 4, Type 5, Type6, Recorder ADPCM and Type MP3-Like.



eAM096, eAM128, eAM192, eAM256, eAM384, eAM512, eAM096S, eAM128S, eAM192S, eAM256S, eAM384 and eAM512S: include Type5,

Type6 coding type.



Stack Pointer Setting: Define stack pointer address. Default address is the max available size address of different Chip.

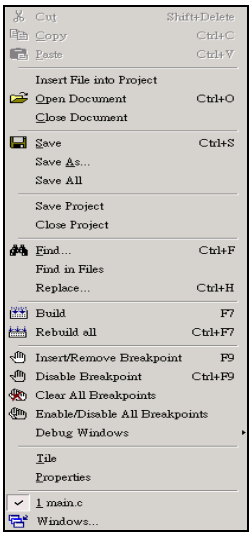
■ *Window Menu*

New Window	Open another window of the same file you are currently editing (for split window viewing)
Cascade	Arrange all open files in cascade formation
Tile	Arrange all open files editing in tile formation
Close All	Close all open files
"1 hello.c"	Indicates number of files and filenames of source file(s) currently active in the Editor window
Windows…	Display Dialog to manipulate source files currently active in the Editor windows

■ *Help Menu*

About ELAN IDE… See information on version of the current eSL/eAM IDE Program

■ Pop-Up Menu



Right Click edit document then IDE will pop-up this menu

(The description of all items please refer to previous pages)

1.2.2.3 Toolbar

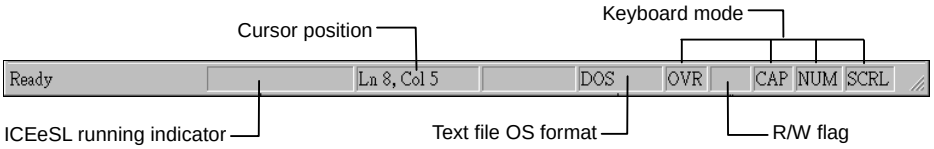
View/hide either **Standard** or **Build** toolbar, or both from **View** menu. The following are the designated function for each of the icons**:**

Standard Tools	Build/Other Tools	Debugging Toolbar
1. Open file (Ctrl+O)	16. Download PROM data	20. Toggle ICE/SW
2. Save file (Ctrl+5)	17. Build(F7)	21. Free Run (Ctrl+F5)
3. Cut (Shift+Del)	18. Rebuild All(Ctrl+F7)	22. Go (F5)
4. Copy (Ctrl+C)	19. Rebuild Source Code	23. Run to Cursor (Ctrl+F10)
5. Paste (Ctrl+V)		24. Step Over (F10)
6. Undo (Alt+Backspace)		25. Step Into (F11)
7. Redo		26. Break Execution (F6)
8. Workspace		27. Exit Debugging (F8)
9. Output		28. Reset (F12)
10. ROM Status		29. Insert/Remove Breakpoint(F9)
11. Find (Ctrl+F)		30. Disable Breakpoint (Ctrl+F9)
12. Print (Ctrl+P)		31. Clear All Breakpoints
13. About		32. Enable/Disable All Breakpoint
14. Play Midi/Speech		33. Get Machine Cycle Count
15. Open EzWave		34. Show Disassembly window

1.2.2.4 Document Bar

The **Document** bar displays the buttons representing each of the active files in the **Editor** window. Click the button of the pertinent file that you wish to place in front of the **Editor** window to perform editing (function is similar with taskbar buttons under Windows).

1.2.2.5 Status Bar



While your project is being debugged with ICEeSL, an ICEeSL running indicator will show in the status bar.

The Cursor position indicates the cursor location within the text **Editor** window.

Text file OS format is DOS, MAC, or UNIX.

R/W flag indicates the active file Read/Write status. If Read only, “Read” will display, otherwise the field is empty.

Keyboard mode displays the status of following keyboard keys**:**

- **Insert** key – OVR is dimmed when overtype mode is off, highlighted when on
- **Caps Lock** key – CAP is dimmed when uppercase character mode is off, highlighted when on
- **Num Lock** key – NUM is dimmed when the numeric keypad calculator mode is off, highlighted when on
- **Scroll Lock** key – SCRL is dimmed when cursor control mode is off, highlighted when on.

Chapter 2
Getting Started with eSL/eAM IDE

2.1 Overview

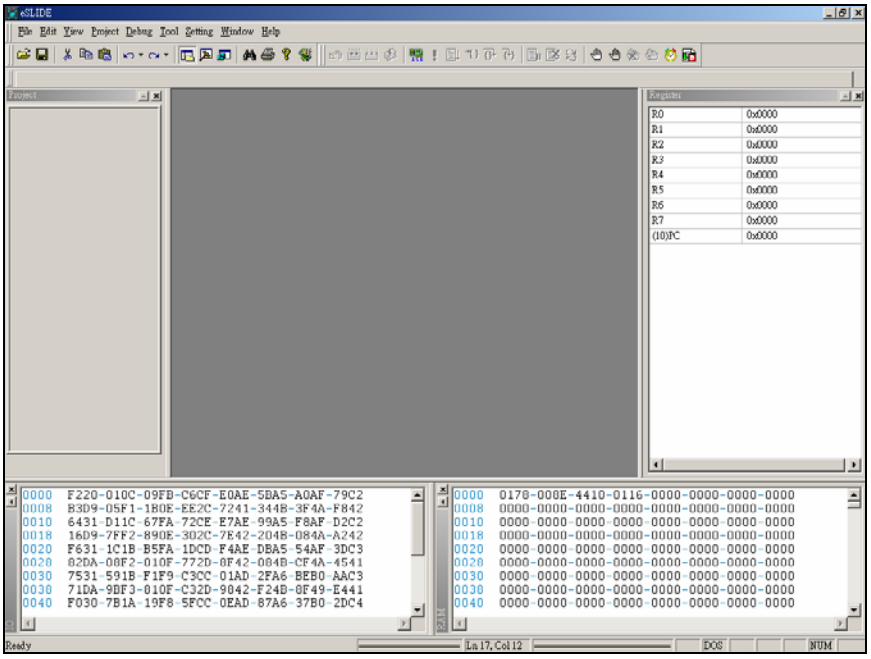
This chapter provides a step-by-step description on -

- How to create a new project under File View Mode
- How to add/remove existing source file in a project.
- How to build projects.
- How to debug an project.

2.2 Starting the eSL/eAM IDE Program

To start eSL/eAM IDE Program, click on the eSL/eAM IDE icon from desktop or from Windows Start menu. When starting from the Start menu, click Programs, then look for eSL/eAM IDE group and click on eSL/eAM IDE icon.

Once the program is started, the main window of the program displays.

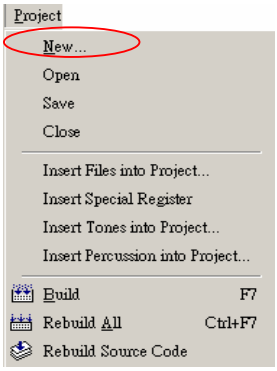


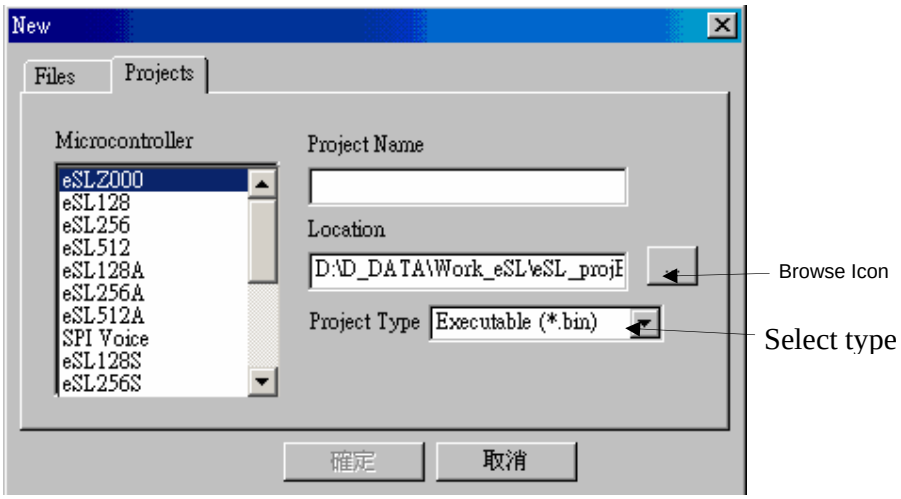
eSL/eAM IDE Program Main Window

2.3 Create a New Project *(about SPI project, please release reference Appendix E)*

To create a new project, you need to configure your project by following these steps**:**

1. From the Menu bar of the eSL/eAM IDE main window,
   click on **File** or **Project** menu and choose **New** command from the resulting **Pull-down** menu.
2. The **New** dialog (shown below) will then display.





"New" Dialog Showing Project Tab for Creating New Project

3. Select **Projects** tab from dialog and assign a name for the new project in the **Project Name** box (suffix ***.prj*** will auto-append to the filename).

4. Locate the folder where you want to store the new project. You may use the **Browse** icon to find the appropriate folder.

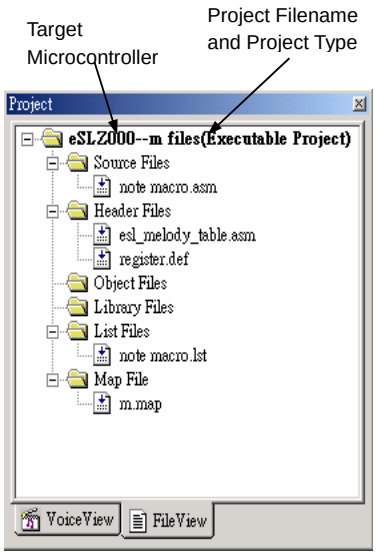
5. Select the target microcontroller for your project from the **Micro Controller** list box.

6. Select the project type for your new project from the **Type** group box (default is Executable Project).

   Executable Project (*.bin): The project can download at ICEeSL, debugging.

   Library Project (*.a): The project only can build as a library code. The function of library file like the *.lib in VC++

7. Click **OK** button after confirming all your choices and inputs.



"Project (File View)" Window

8. IDE will create some header files for user's project

File Name	Command
For assembler project	
register.def	Define all register symbol and address
registerbit.def	Define all register bit symbol and address
registerExt.def	Extern all register symbol
vector.def	Define .vector table
peripheral.def	Define peripheral macro and routine
Interruptvector.def	Define interrupt vector table
For c project	
Interruptvector.h	Define interruput vector function
c_register.h	Define all register symbol and address
c_registerbit.h	Define all register bit symbol and address

The new project is created with the defined project name, microcontroller and project type you have selected displayed on top of the **Project** window.

2.4 Add and Remove Source Files from/to Project

You can either insert existing source files into the new or existing project, or create new ones from within eSL/eAM IDE text Editor and automatically insert them into the new project.

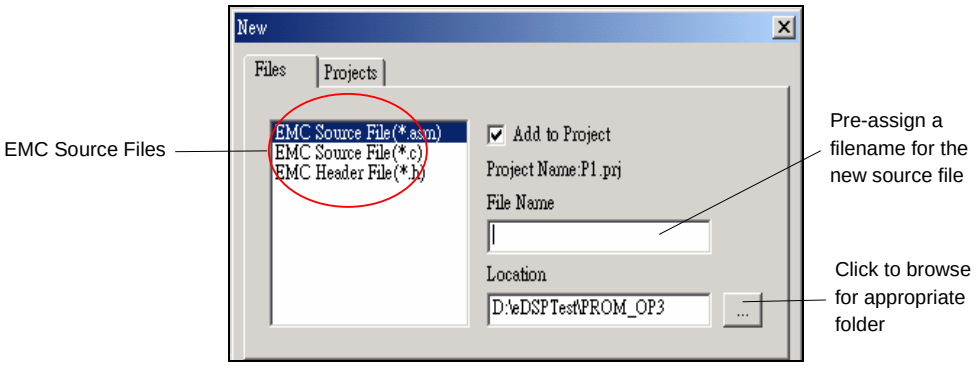
2.4.1 Create New Source File for the Project

If your source file is yet to be created, you can take advantage of the **New** dialog (by clicking **New** command from the File menu) to create your new source file filename and use the ESL/EAM IDE text editor to compose its content.

1. Click the **Files** tab of the **NEW** dialog and select the type of source file you want to create from the **EMC Source File** list box, i.e., **.asm* (default) for assembly file; **.c* for C Language file, and **.h* for header file. New the first assembler file (*.asm), eSL/eAM IDE will include "vector.def", "register.def", "eSLMacro.def", "Interruptvector.def" and eSL or eAM speech/melody macro define file ("eSLMSMacroDefine.def "or "eAMMSMacroDefine.def"), automatically. When new the first c file (*.c), eSL/eAM IDE will include "interruptvector.h", and include "ecc_extend.h" for each new c file.

NOTE

1. *In asm project "eSLMSMacroDefine.def " or "eAMMSMacroDefine.def" must be preceeded by "interruptvector.def"*
2. *In c project "ecc_extend.h" must be preceeded by "interruptvector.h"*



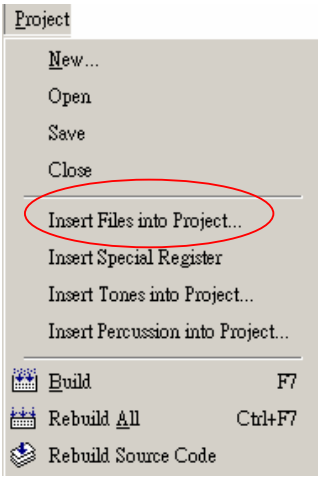
"New" Dialog Showing File Tab for Creating a New Source File

2. Assign a filename for the new source file in the **File Name** box.
3. Locate the folder where you want to store the new source file in your disk. You may use the **Browse** icon to find the appropriate folder.
4. Check **Add to Project** check box (default) if you want to automatically add the new file into your project. Otherwise clear the check box.
5. Click OK button after confirming your inputs. You will be prompted to start writing the newly defined source file in the **Editor** window.

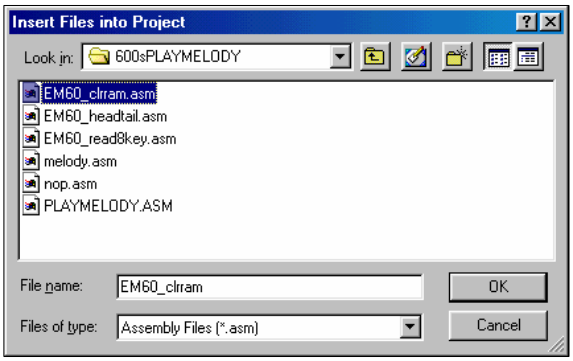
2.4.2 Add Existing Source Files to the New Project

If your source file is ready, you can immediately insert it into your new project.

1. From the Menu bar, click on **Project** menu. Choose **Insert Files to Project** command from the resulting pull-down menu and the **Insert Files into Project** dialog will display.



"Project" Menu



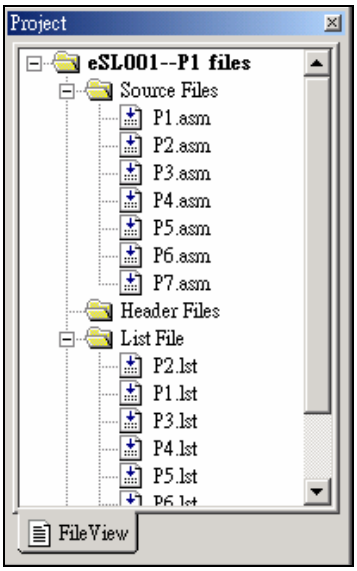
"Insert File into Project" Dialog

2. Browse and select the file or multiple select the files you wish to insert into the new project.
3. Click **OK** button after confirming your choice.

2.4.3 Open Source File or Display its Path

You can open source file into **Editor** window for editing from **Project** (FileView) window. To do this, double click on the source file and the file is automatically opened.

2.4.4 Deleting Source Files from Project



"Project (File View)" Window

From the **Project** window, select the file(s) you wish to delete. Then press the **Delete** key from your keyboard.

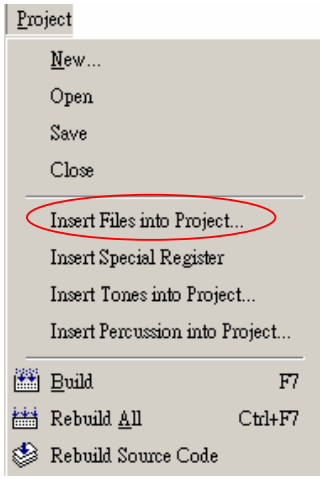
2.5 Add and Remove Voice Files from/to Project

You can insert existing voice files into the new or existing project, inserted file will add to **Voice View** in **Project Window**. Voice files include speech files (*.wav), melody files (*.mid) or user define file (*.bin,*.tbl).

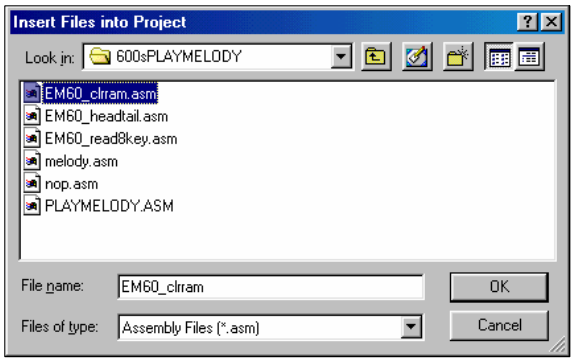
2.5.1 Add Existing Voice Files to the Project

You can add voice file by next two methods.

1. From the Menu bar, click on **Project** menu. Choose **Insert Files to Project** command from the resulting pull-down menu and the **Insert Files into Project** dialog will display. You can select which type of file want to insert (speech file (*.wav), midi file (*.mid), user define file (*.bin,*.tbl)). Then the selected file will insert at corresponding node in the voice view window.

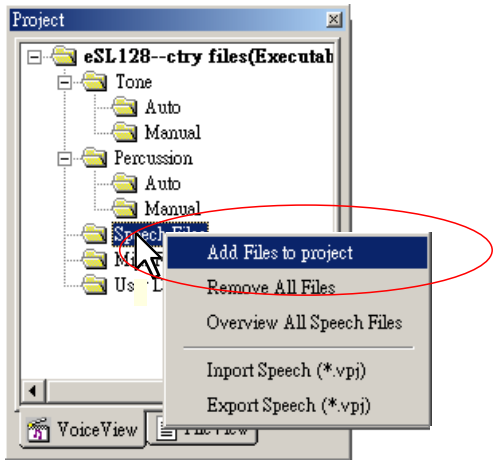


"Project" Menu



"Insert File into Project" Dialog

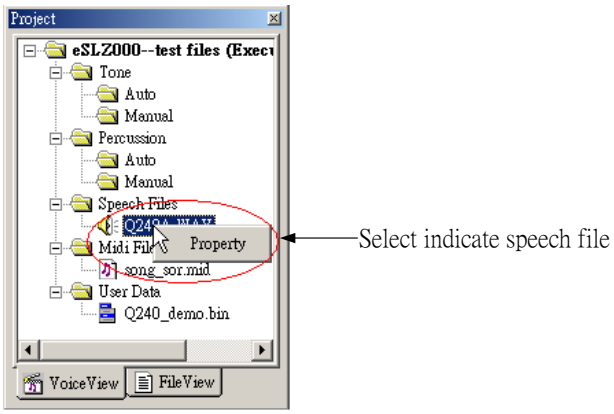
2. On the other hand, you can clicking mouse left button at the "Speech File", "Midi File" and "User Data" node in voice view window. eSL/eAM IDE will pop-up one pop menu for you to select the desired file from the resulting "Insert Files" dialog. The same, the selected file will insert at corresponding node in the voice view window.



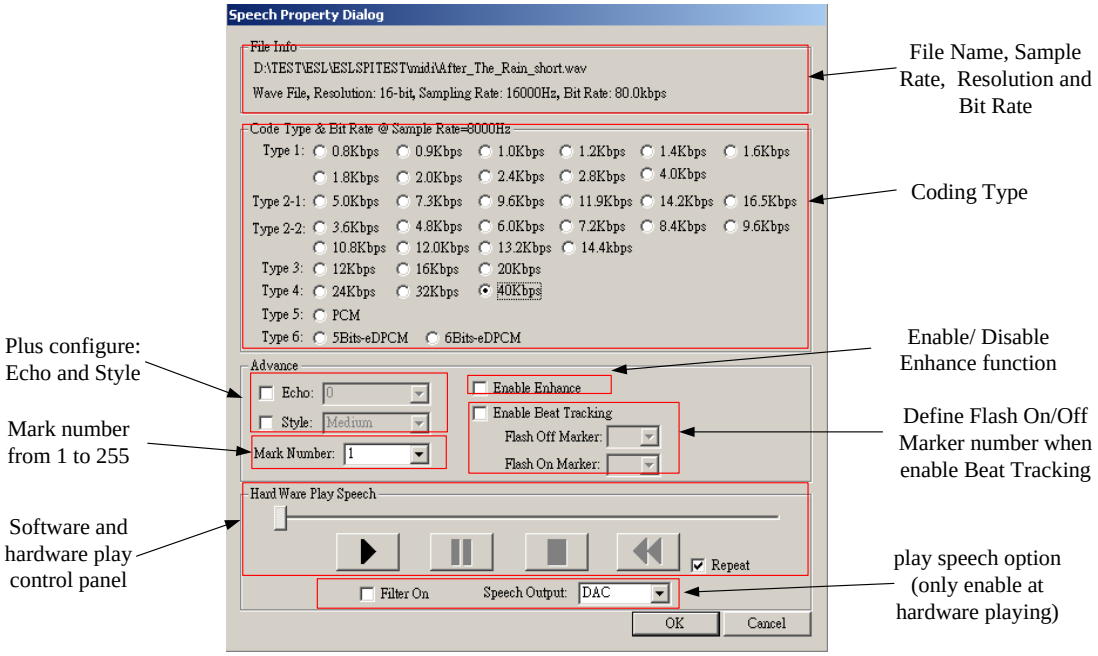
Insert voice file by clicking mouse left buttom

2.5.2 Encode Speech Files in the Project

User can click mouse left buttom at indicate speech file and open “Speech property” dialog to select speech option to encode speech file.



Set speech option by clicking mouse left buttom


Speech Property Dialog
File Info
D:\TEST\ESL\ESLSPITEST\midi\After_The_Rain_short.wav
Wave File, Resolution: 16-bit, Sampling Rate: 16000Hz, Bit Rate: 80.0kbps
Code Type & Bit Rate @ Sample Rate=8000Hz
Type 1: 0.8Kbps 0.9Kbps 1.0Kbps 1.2Kbps 1.4Kbps 1.6Kbps 1.8Kbps 2.0Kbps 2.4Kbps 2.8Kbps 4.0Kbps
Type 2-1: 5.0Kbps 7.3Kbps 9.6Kbps 11.9Kbps 14.2Kbps 16.5Kbps
Type 2-2: 3.6Kbps 4.8Kbps 6.0Kbps 7.2Kbps 8.4Kbps 9.6Kbps 10.8Kbps 12.0Kbps 13.2Kbps 14.4kbps
Type 3: 12Kbps 16Kbps 20Kbps
Type 4: 24Kbps 32Kbps 40Kbps
Type 5: PCM
Type 6: 5Bits-eDPCM 6Bits-eDPCM
Advance
Echo: 0
Style: Medium
Mark Number: 1
Enable Enhance
Enable Beat Tracking
Flash Off Marker:
Flash On Marker:
Hard Ware Play Speech
Repeat
Filter On
Speech Output: DAC
OK
Cancel
File Name, Sample Rate, Resolution and Bit Rate
Coding Type
Plus configure: Echo and Style
Enable/ Disable Enhance function
Mark number from 1 to 255
Define Flash On/Off Marker number when enable Beat Tracking
Software and hardware play control panel
play speech option (only enable at hardware playing)

Speech Proterty Dialog

Speech Property Dialog: This dialog let user set coding type, plus configure (echo and style) and mark numbers by indicate speech file. On the other hand, it also support play control panel and option (Filter On and output port) for user can immediately listen speech data status from PC or ICEeSL.

File Info: about file full path, resolution, sample rate and Bit Rate.The Bit Rate will exchange between different coding type and different sample rate.

Code Type: eSL/eAM IDE support Type1 ~Type6 coding type for eSLZ000, eSL032A, eSL128A, eSL256A and eSL512A, others, only support Type4, Type 5, Type 6. Default is Type 3 and bit rate is 12Kbps.

Plus Configuration: include echo (from 0~5), style (hard, medium and soft) and enhance.

Mark Number: set the max mark number for indicate speech file.

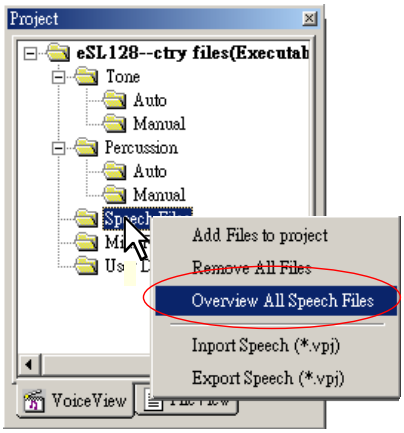
Enable Beat Tracking: Enable this function, IDE will automatically add beat tracking flash on and flash off marker into wave.

NOTE
1. Default flash On marker number is the maxinum number in marker number combobox
2. Defualt flash Off marker number is the the maxinum number - 1 in marker number combox
3. The beat tracking markers are accurate when wave sample rate is 8K

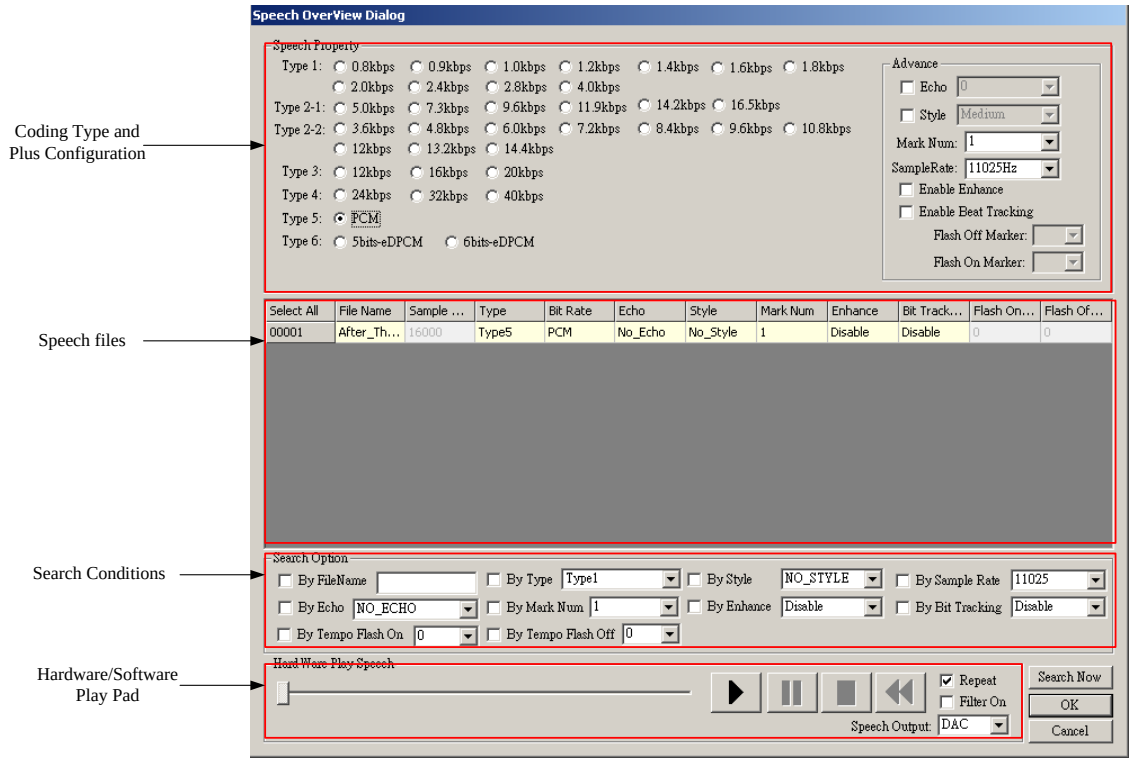
Play Control Panel: eSL/eAM IDE allow user can immediately listening speech data status through select different code type, plus configuration, and playing option. You can listens speech from PC (software) or ICEeSL (hardware).

Playing Option: include upsample and output port. These options are only enable at hardware connected status. Filter On used to make the wave sound smoothly. Output port includes three interfaces, DAC, PWM 32K and PWM 64K.

Besides, using **Speech Property Dialog**, you also can select **Overview all speech files** option by R-Click mouse at **Speech** folder to select you want coding type, encho, type or mark number.



Overview all sppech files

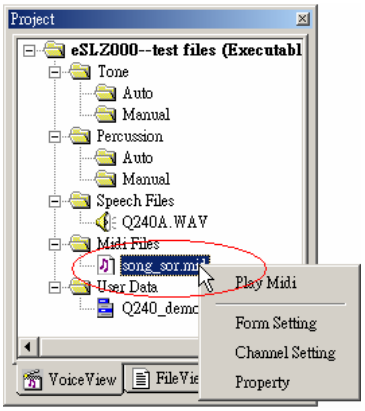


Speech Overview Dialog: In this dialog you can multi select files and set Coding type, Echo, Style and Mark Num at one time. You also can search files by different condition at **Search Option** section. After searching, all of fit speech files will be highlighted.

2.5.3 Build Midi Files in the Project

User can click mouse left buttom at indicate midi file and eSL/eAM IDE will pop-up a pop menu for usert to set some midi properties before build midi data.

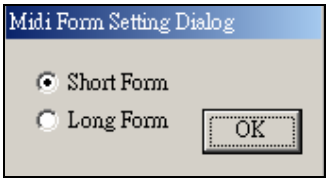
> **NOTE**
> *Don't use Asian text font as midi file name, like Traditional Chinese, Japenese, and extra.*



Set midi option by clicking mouse left buttom

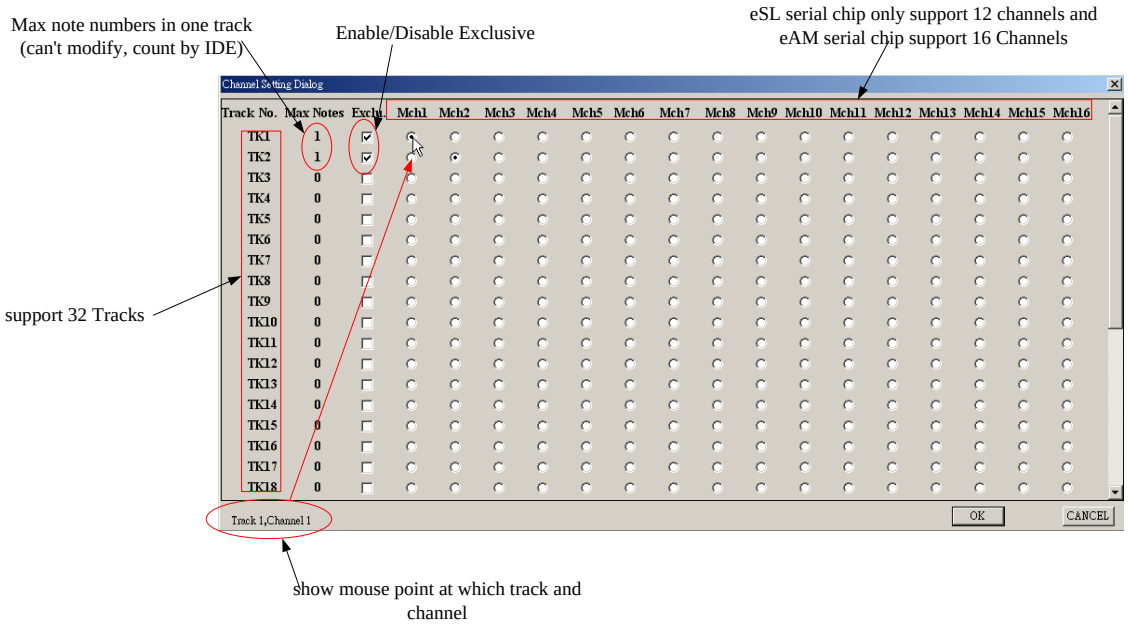
Play Midi: Let user can immediately listen midi data status before build midi file. This function only enable at ICEeSL connected.

Form Setting: eSL/eAM IDE support short and long form option before build midi data. Default is Short form.



Midi form setting dialog

Channel Setting: Channel Setting dialog support user to indicate which track assign to which channel by max notes. eSL/eAM IDE support 32 tracks and 16 channels.



Midi channel setting dialog

Track No.: eSL/eAM IDE support 32 Tracks

Max Notes: The max note numbers playing in the same time. In addition, max notes also mean the max channels which user can assign. (by Track). Max Notes is calculated by eSL/eAM IDE.

Exclu.: Enable/Disable track's notes must be assigned in indicate channels, on the other hand, other track's notes also can't insert into these locked channel.

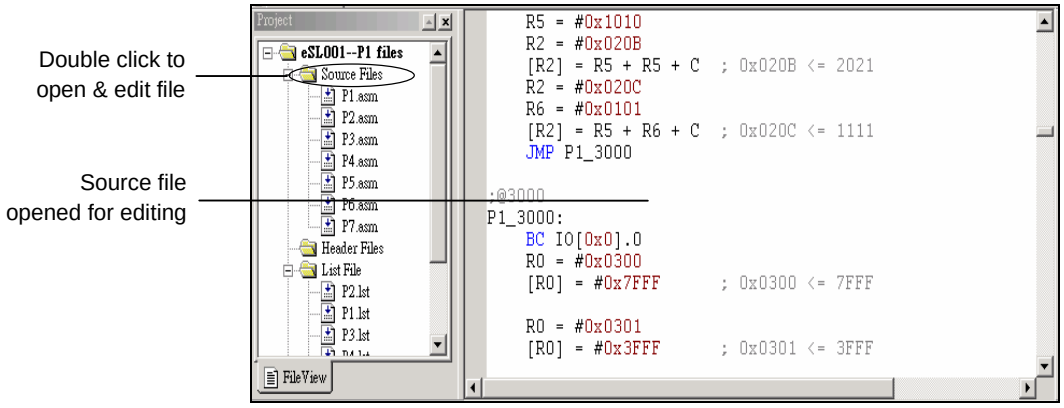
NOTE

One channel only can be assigned to one track

Property: show midi file property.

2.6 Edit a Source File From and Within Project

You can edit source files that are already inserted in the project. To do so, double click the source file you wish to edit from the **Project** window and the file will open in the **Editor** window of the eSL/eAM IDE Program



Editing Source File From and Within Project

2.7 Build Project

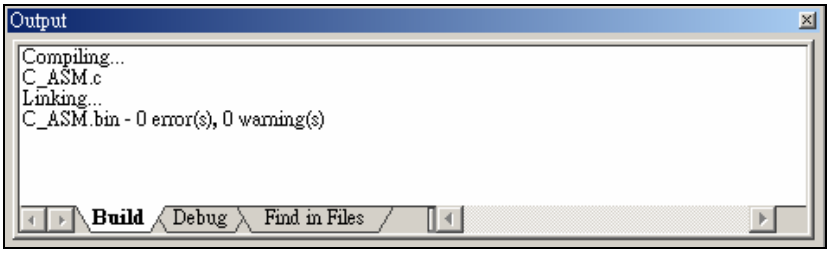
With your source file(s) inserted into the project, you are now ready to compile your project.

2.7.1 Compiler, Assemble and Link Files to Generate Binary File

With the source file(s) shown in the **Project** window –

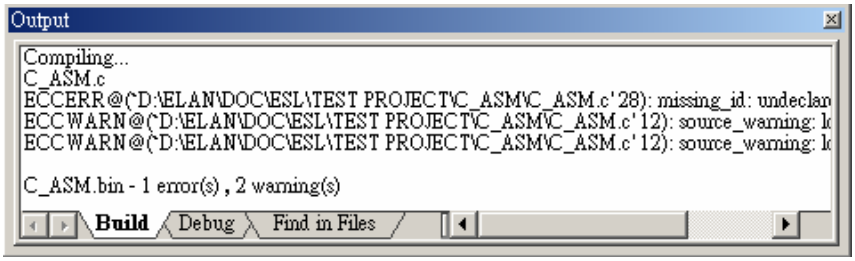
- Click **Rebuild All** command to assemble and link all inserted files regardless of having been recently modified or not.
- Click **Build** command from the **Project** menu to assemble and link only those source files that were recently modified.

eSL/eeAM IDE will assemble and link all source files to generate binary (**.bin*) files using your project name as filename. The binary file is automatically saved in the same folder where your source files are located. Status of the assembly operation can be monitored from the **Output** window as shown below.



Output Window Showing Successful Compile, Assemble & Link Compilation

If error is detected during compilation, pertinent error message will also display in the **Output** window. Double click on the error message to link to the source of error from corresponding program text line in the **Editor** window.



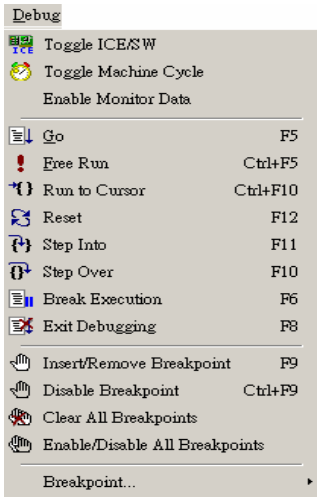
Output Window Showing Compiler, Assembler & Link Compilation Errors

Modify source files to correct the errors and repeat Compiler assembler and link operations.

2.8 Debugging a Project

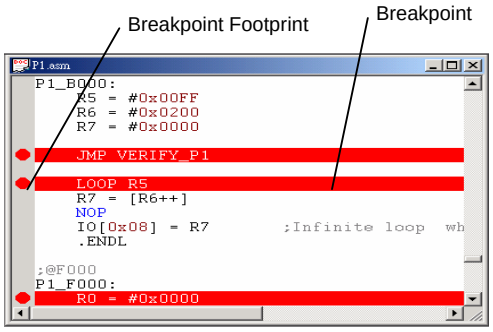
With the source files deprived of its errors, you are now ready to debug the files. Be sure the ICEeSL is properly connected to your computer.
Debugging commands are available from the **Debug** Menu as well as from the eSL/eAM IDE Program Toolbar.

Toolbar for Debugging Commands



2.8.1 Breakpoints Setup

To assign a breakpoint, position cursor at any source line where a breakpoint is going to be set, and then press **F9** key. Observe the line highlighted in red with a red footprint (dot) indicator to its left.

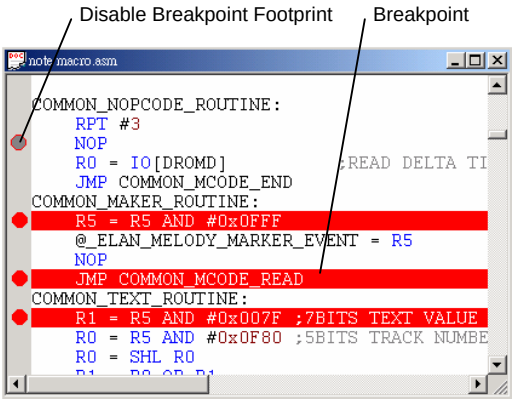


Active Source File with a Defined Breakpoint

You can also click on the **Insert/ Remove Breakpoint** icon (hand shape) on the toolbar, or choose **Insert/Remove Breakpoint** command from the **Debug** menu to set the breakpoint.

To disable breakpoint, position cursor at any source line where a breakpoint is enabled, and then press **Ctrl+F9** key, then the line highlighted in red with a red footprint (dot) will exchange with a gray footprint (dot).

You can also click on the **Disable Breakpoint** icon (hand shape) on the toolbar, or choose **Disable Breakpoint** command from the **Debug** menu to set the breakpoint.



Active Source File with a disable Breakpoint footprint

Likewise, the defined breakpoint is cleared if **F9** or the hand icon is clicked the second time with the cursor positioned on the defined breakpoint. To clear all existing breakpoint, click **Clear All Breakpoints** command from **Debug** menu or its icon from **Toolbar**. Note that this method of clearing a breakpoint will also remove the breakpoint footprint.

Otherwise, to Disable or Enable all existing breakpoint, click **Enable/Disable All Breakpoints** command from **Debug** menu or its icon from **Toolbar**. Note that this method of disable or enable all breakpoints will also disable or enable all breakpoint footprints.

2.8.2 Debugging Tools

Start and perform debugging with the following commands from the **Debug** menu or their pertinent icons from **Toolbar:**

ICE/SW – Switch Debugger mode between ICEeSL and Simulator

F5

Go - Run program starting from the current program counter until breakpoints are hit and breakpoint address executed.

Ctrl+F5

Free Run - Run program starting from the current program counter until **Break Execution** command occurs. All defined breakpoints are ignored during free run.

F11

Step Into - Execute EZ parameter step-by-step (with register contents updated at the same time).

F10

Step Over – Same as Step Into command.

Run to Cursor - Run program starting from the cur rent program counter up to the location where the cursor is anchored (applies to ICE debug mode only).

F6

Break Execution - Stop running program without ICE reset (program will resume running from the location where it was last stopped).

F12

Reset - Perform hardware reset (register contents are displayed with initial values). ICEeSL will return to its initial condition.

F8

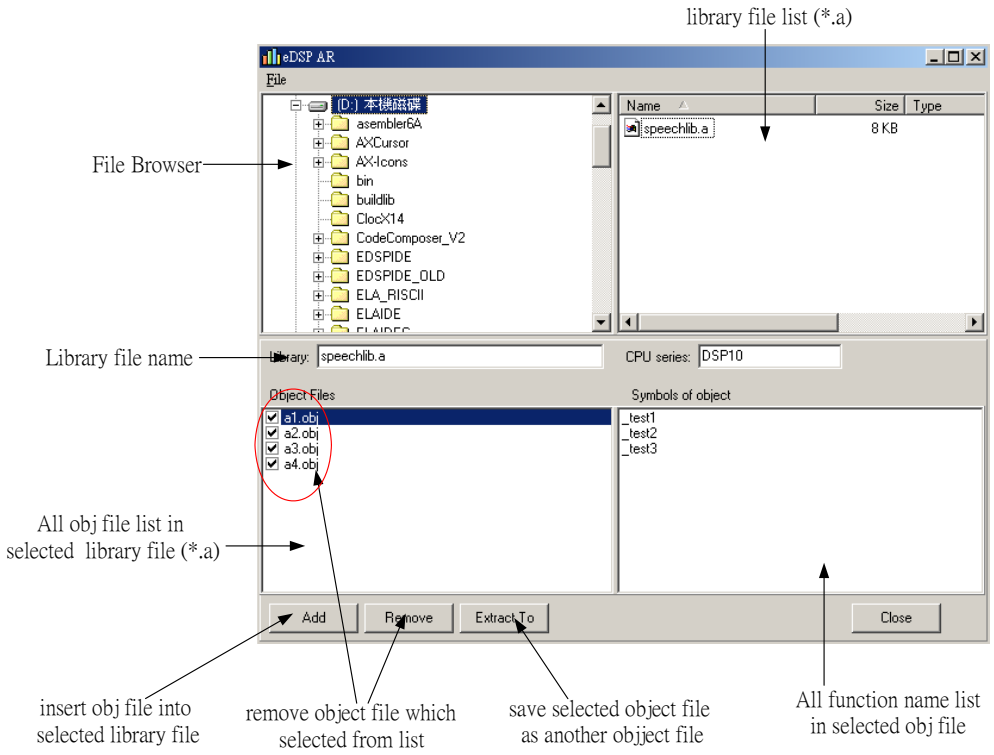
Exit Debugging - Set Debug in normal (editable) mode and ICE reset is carried out (Debug in debugging mode sets the **Editor** window to read only)

Machine Cycle - Enable or disable display of the instruction cycle count of executed instructions

Disassembly Window – Show Disassembly Window. (Only enable at C project debugging mode)

Appendix A
Library Tool Introduction

A.1 Overview

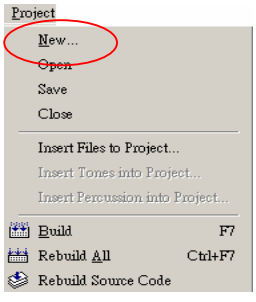


A.2 Create New Library file

The eSL/eAM IDE support two methods to create library.

A.2.1 Create library file from eSL/eAM IDE

A.2.1.1 New Project

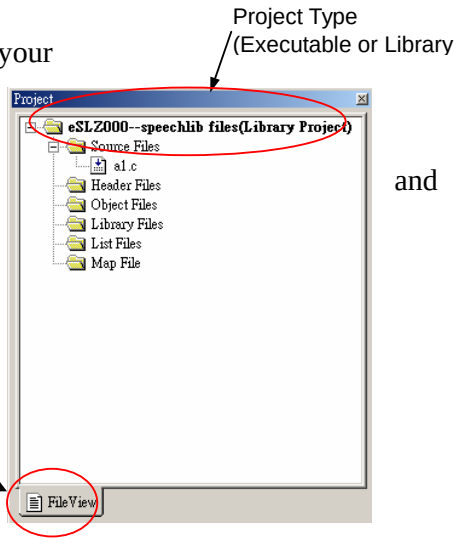


To create a new project, you need to open eSL/eAM IDE and configure your project by following these steps**:**

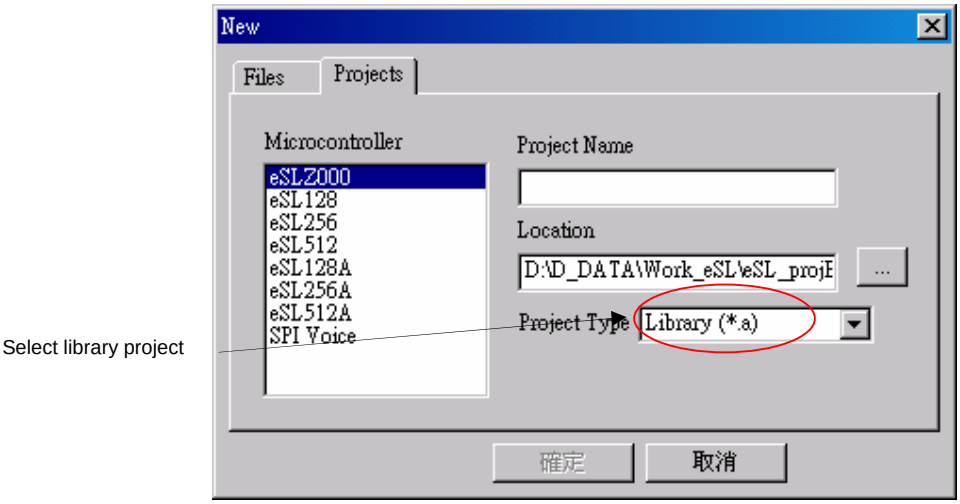
1. From the Menu bar of the eSL/eAM IDE main window, click on **File** or **Project** menu and choose **New** command from the resulting **Pull-down** menu.

2. The New dialog (shown below) will then display.
3. Select Library Project from Project Type combo box.
4. Locate the folder where you want to store the new project. You may use the Browse icon to find the appropriate folder.
5. Select the target microcontroller for your project from the Macro Controller list box.
6. Select the project type for your new project from the Type group box (default is ASM).
7. Click OK button after confirming all your choices and inputs.

The new project is created with the defined project name , microcontroller project type you have selected displayed on top of the **Project** window.



and



"New" Dialog Showing Project Tab for Creating New Project

A.2.1.2 Add and Remove Source Files from/to Project

Please reference Section 2.4

A.2.1.3 Edit a Source File From and Within Project

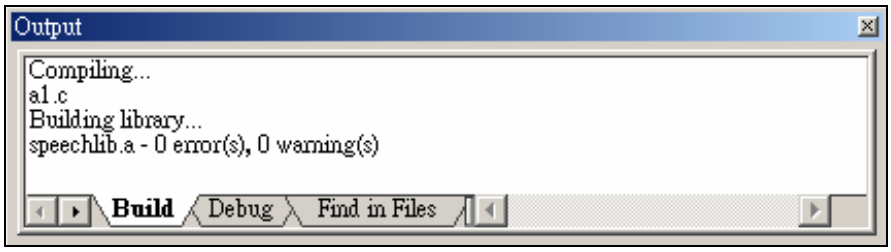
Please reference Section 2.5

A.2.1.4 Build Project

With your source file(s) inserted into the project, you are now ready to compile your project. With the source file(s) shown in the Project window –

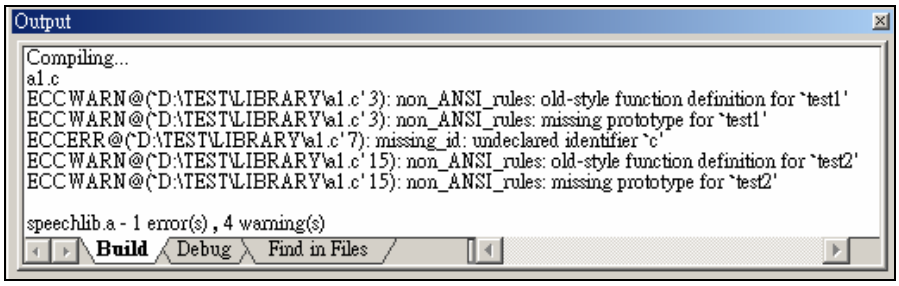
Click Rebuild All command to assemble and link all inserted files regardless of having been recently modified or not.

Click Build command from the Project menu to assemble and link only those source files that were recently modified. eSL/eAM IDE will assemble and link all source files to generate binary (*.a) files using your project name as filename. The binary file is automatically saved in the same folder where your source files are located. Status of the assembly operation can be monitored from the Output window as shown below.



Output Window Showing Successful Compile, Assemble & Link Compilation

If error is detected during compilation, pertinent error message will also display in the Output window. Double click on the error message to link to the source of error from corresponding program text line in the Editor window.


Output
Compiling...
a1.c
ECC WARN @('D:\TEST\LIBRARY\a1.c' 3): non_ANSI_rules: old-style function definition for `test1'
ECC WARN @('D:\TEST\LIBRARY\a1.c' 3): non_ANSI_rules: missing prototype for `test1'
ECC ERR @('D:\TEST\LIBRARY\a1.c' 7): missing_id: undeclared identifier `c'
ECC WARN @('D:\TEST\LIBRARY\a1.c' 15): non_ANSI_rules: old-style function definition for `test2'
ECC WARN @('D:\TEST\LIBRARY\a1.c' 15): non_ANSI_rules: missing prototype for `test2'
speechlib.a - 1 error(s) , 4 warning(s)
Build
Debug
Find in Files

Output Window Showing Compiler, Assembler & Link Compilation Errors

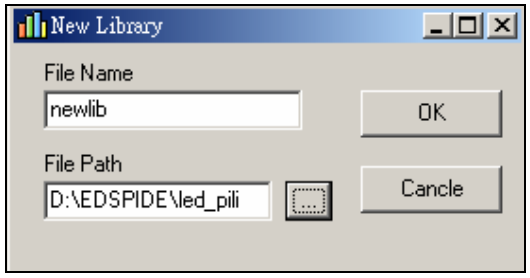
Modify source files to correct the errors and repeat Compiler assembler and link operations.

> **NOTE**
> 1. *eSL/eAM IDE doesn't support debugger in Library project*
> 2. *Library project only has File view*
> 3. *Library project can't insert voice file.*

A.2.2 Create Library File from Library Tool

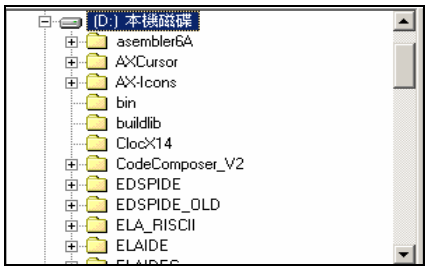
User can create new library file form library tool by following these steps:

1. From the Menu bar of the tool main window, click on File menu and choose New library command from the resulting Pull-down menu.
2. The New Library dialog (shown below) will then display.
3. Locate the folder where you want to store the new file. You may use the Browse icon to find the appropriate folder
4. Click OK button after confirming all your choices and inputs.

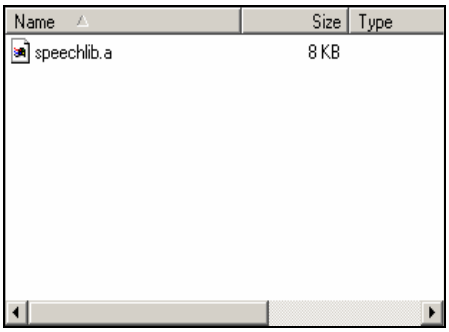


A.3 Library Tool Sub-Window

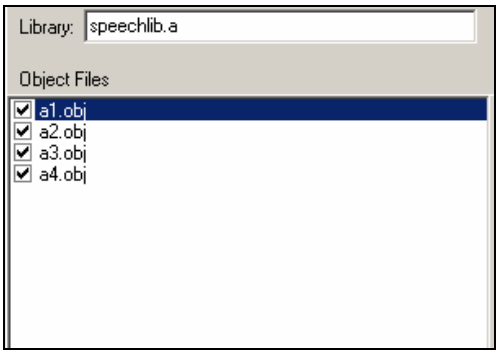
■ **File Browser:** Search folder that include library file (*.a) from this sub-window.



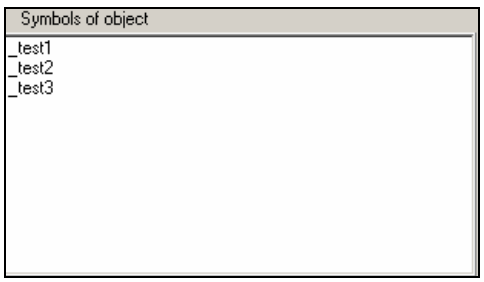
■ **Library File List:** List library file (*.a)



■ **Object File List:** List all object files include in selected library file (*.a)



■ **Symbol List:** List all function names include in selected object file (*.obj)



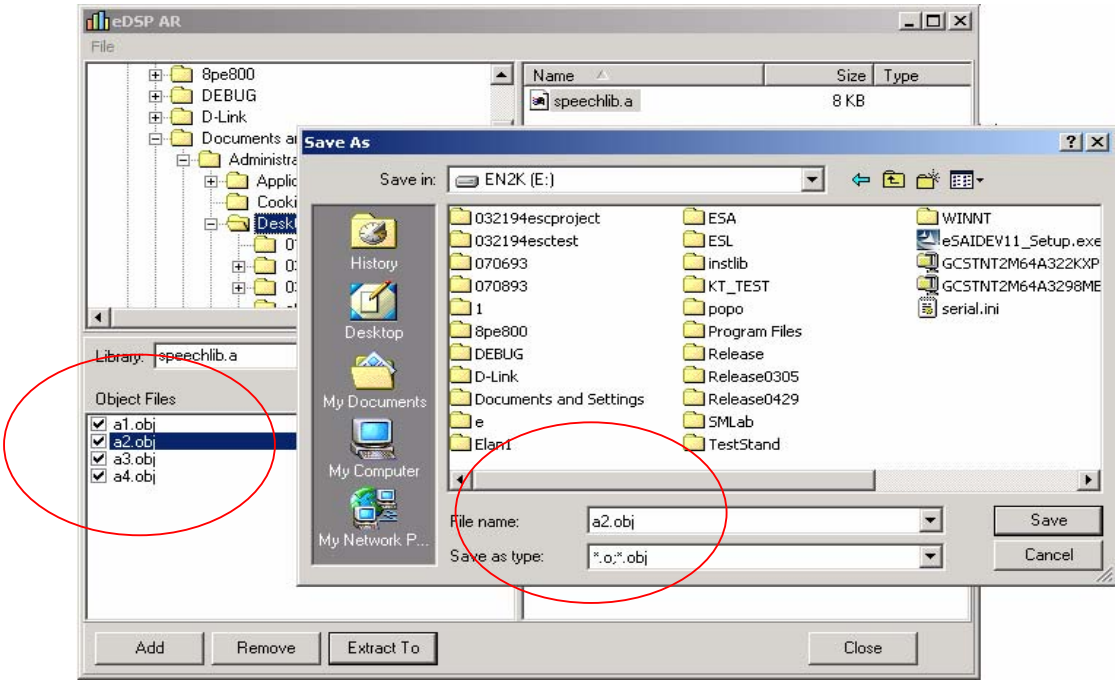
A.4 Library Tool Buttons

Add Add additional object file into selected library file.

Remove Remove object files which selected form object file list window.

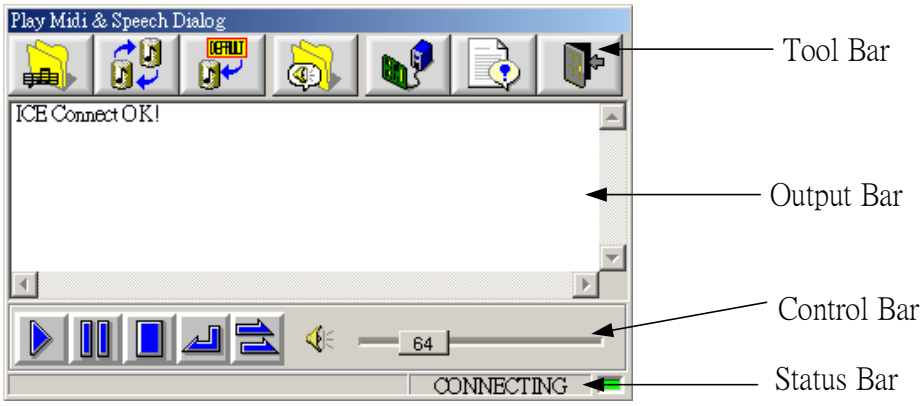
Extract To Save highlighted object file as another object file. (shown following)

Close Close library tool.



Appendix B
Play Midi & Speech Dialog Introduction

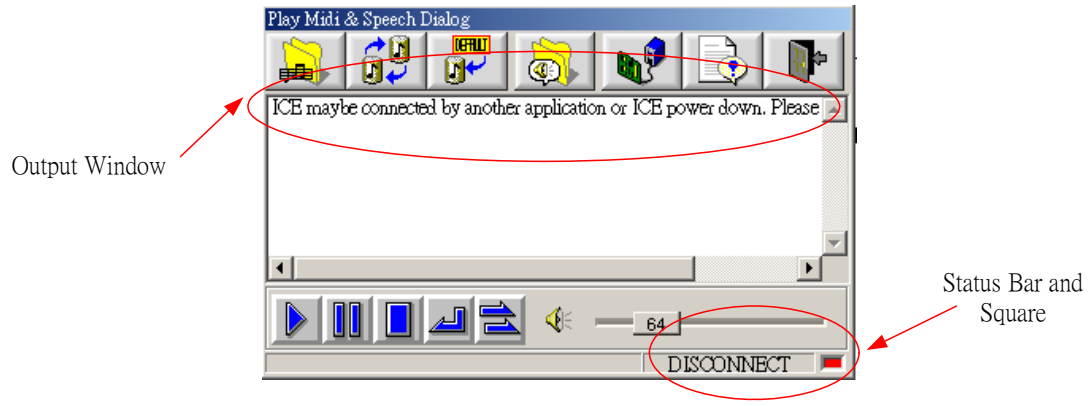
B.1 Overview



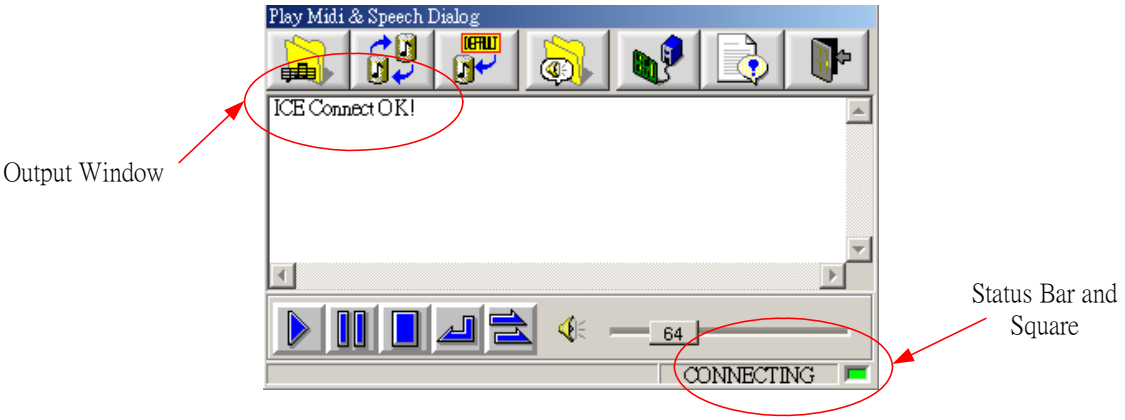
B.2 Connect ICEeSL

This Application only allows user play midi and speech at ICEeSL, so user must check ICE connected first. User can check ICEeSL connection status throw output window, the square at the button right of dialog (Red: Disconnect, Green: Connected) and status bar.

User can click button to connect ICEeSL.


Play Midi & Speech Dialog
ICE maybe connected by another application or ICE power down. Please
Output Window
64
DISCONNECT
Status Bar and Square

Disconnect status

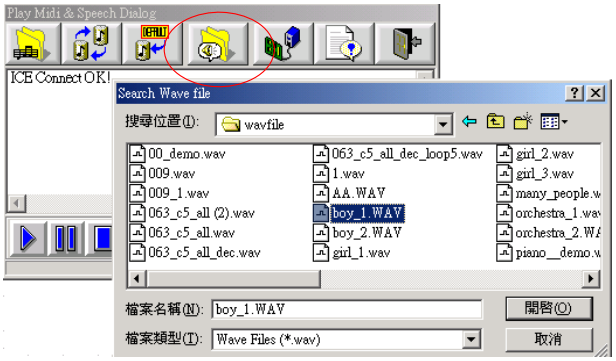


Connected status

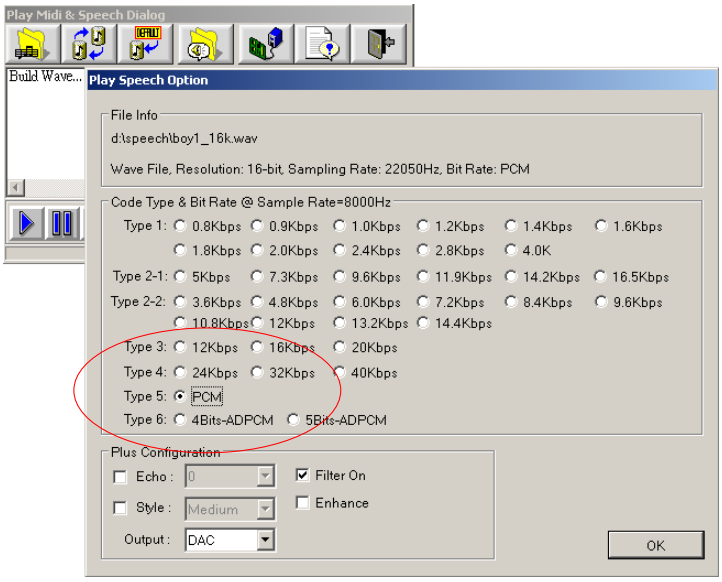
B.3 Build and Play Speech

User can click button to build speech file.

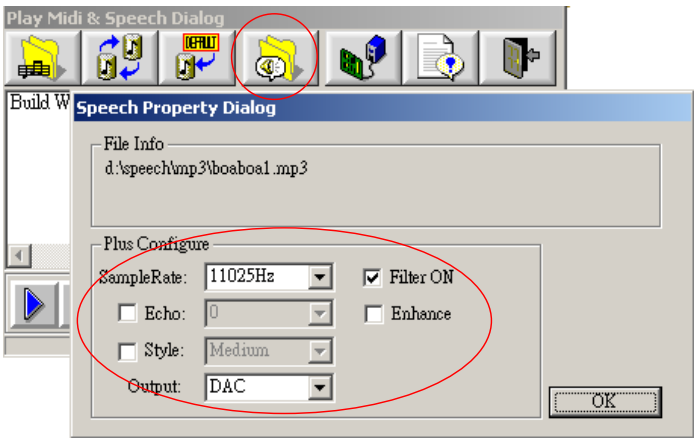
1. Select Speech file (*.wav, *.mp3, *.wma)



2. Select speech property: User can select different property to build speech.

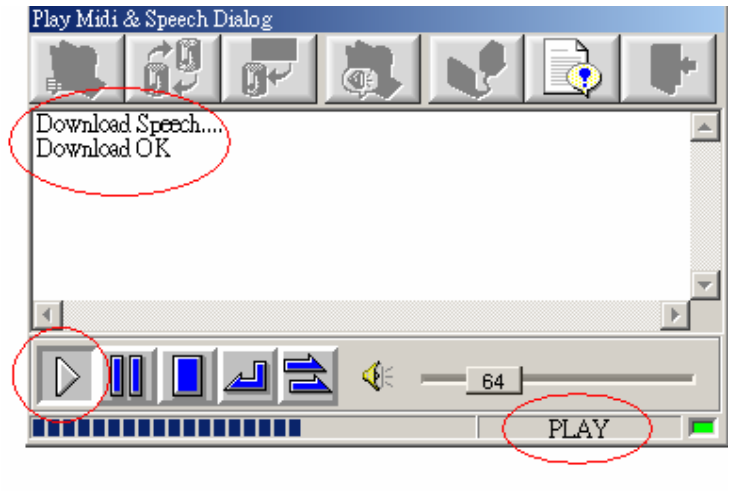

Play Midi & Speech Dialog
Build Wave...
Play Speech Option
File Info
d:\speech\boy1_16k.wav
Wave File, Resolution: 16-bit, Sampling Rate: 22050Hz, Bit Rate: PCM
Code Type & Bit Rate @ Sample Rate=8000Hz
Type 1: 0.8Kbps 0.9Kbps 1.0Kbps 1.2Kbps 1.4Kbps 1.6Kbps
1.8Kbps 2.0Kbps 2.4Kbps 2.8Kbps 4.0K
Type 2-1: 5Kbps 7.3Kbps 9.6Kbps 11.9Kbps 14.2Kbps 16.5Kbps
Type 2-2: 3.6Kbps 4.8Kbps 6.0Kbps 7.2Kbps 8.4Kbps 9.6Kbps
10.8Kbps 12Kbps 13.2Kbps 14.4Kbps
Type 3: 12Kbps 16Kbps 20Kbps
Type 4: 24Kbps 32Kbps 40Kbps
Type 5: PCM
Type 6: 4Bits-ADPCM 5Bits-ADPCM
Plus Configuration
Echo : 0
Filter On
Style : Medium
Enhance
Output : DAC
OK

Select Speech Property (for wav file)



Select Speech Property (for mp3and wma file)

3. Play speech: user can click button to play speech. Before the first playing, the dialog will auto-download builded speech data into ICEeSL.



B.4 Build and Play Midi

B.4.1 Change Different Midi Tone Library

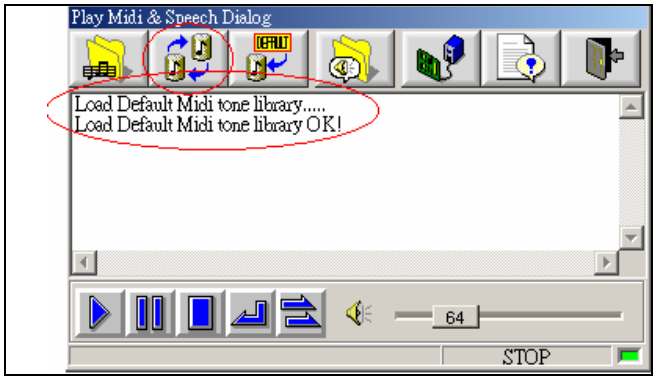
What is midi tone library?

The midi tone library is the file (*.inp) which collects different instrument or percussion data. User can create this file from EZWave (please refercnce EZwave Guide).

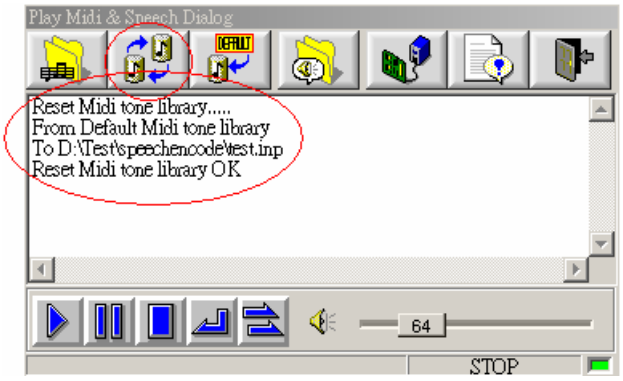
How to download midi tone library?

In this dialog, we support default midi tone library. Uuser can click

button to download defult midi tone library as new active library. In addition, user also can click button to download different midi tone library as new active library.



Load Default midi tone library as new active library



Load Different midi tone library as new active library

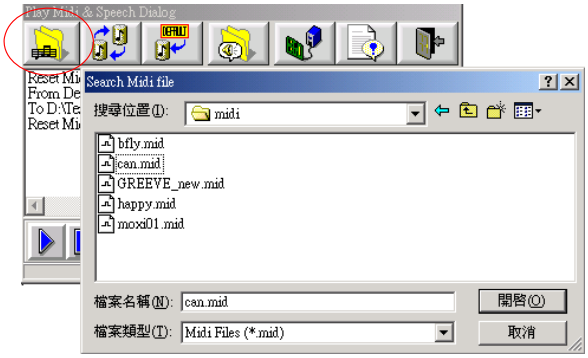
NOTE:

1. If user doesn't change midi tone library, the default midi tone library will be set as activelibrary.
2. The active library is valid until user change midi tone library.

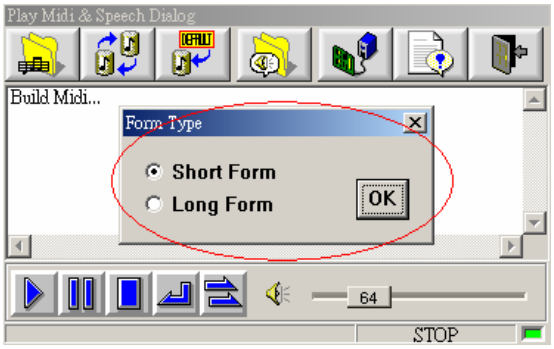
B.4.2 Build and Play Midi

User can click button to build midi file.

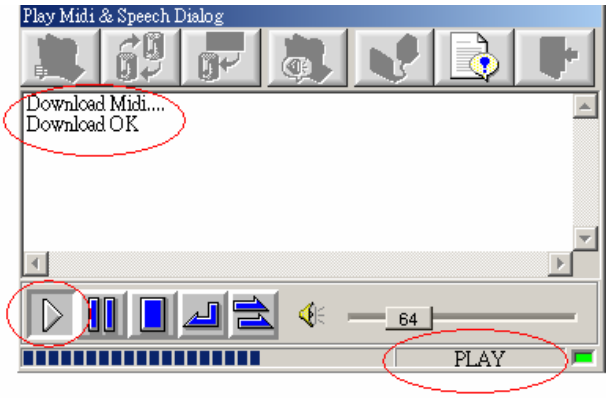
1. Select midi file (*.mid)



2. Select form type

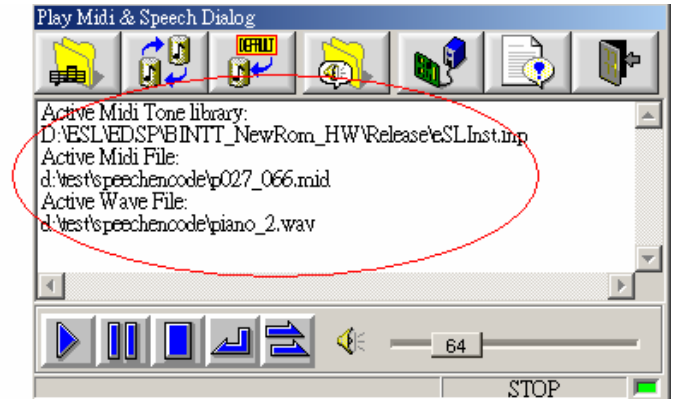


3. Play midi: user can click button to play midi. Before the first playing, the dialog auto-download builded midi data into ICEeSL.

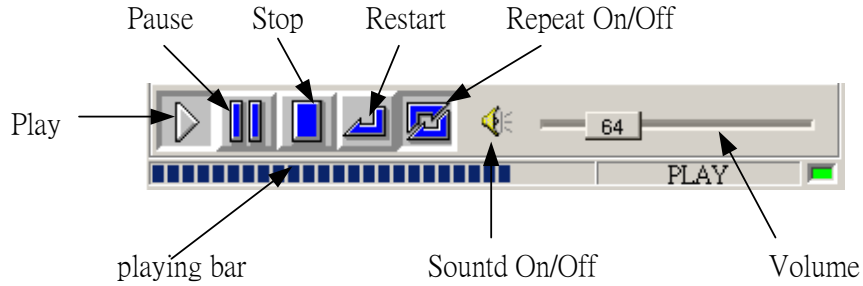


B.5 Get Information

User can click button to get new active midi tone library, active midi file and active speech file.



B.6 Playing Midi or Speech



Play midi or speech button

Pause midi or speech playing button

Stop midi or speech playing button

Restart(Reset) playing button

No Repeat playing midi or speech button

Repeat playing midi or speech button

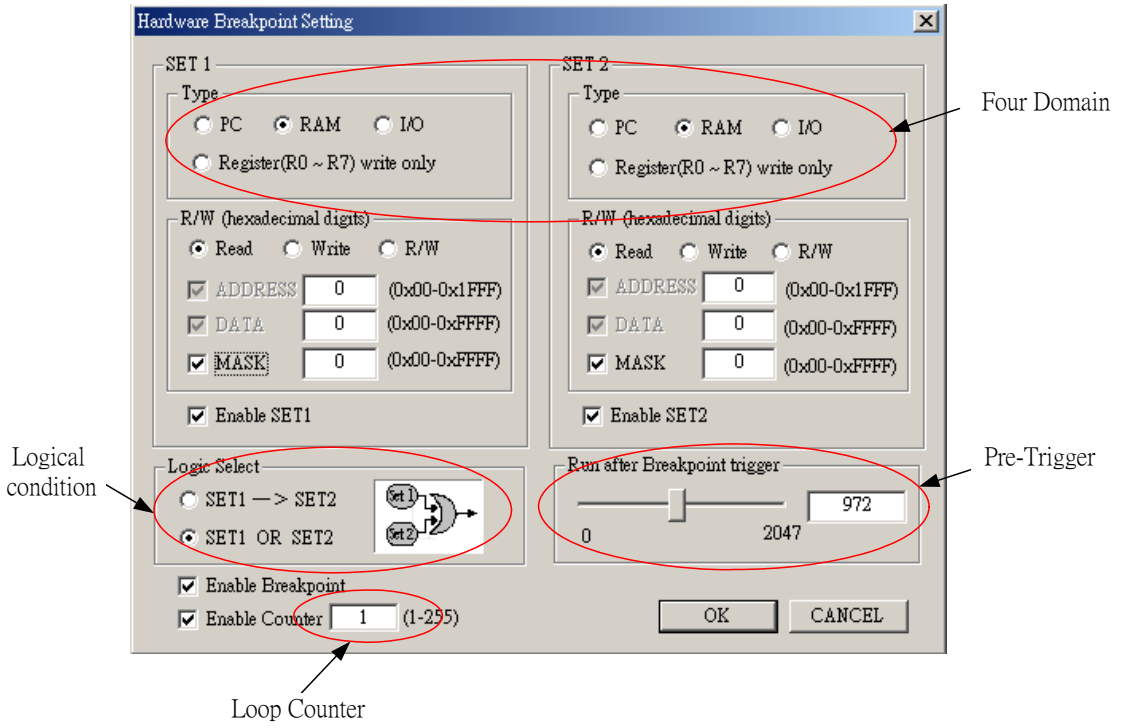
Sound on button

Sound off button

Volume slider bar

Appendix C
How to Use Hardware Breakpoint

C.1 Hardware Breakpoint Setup



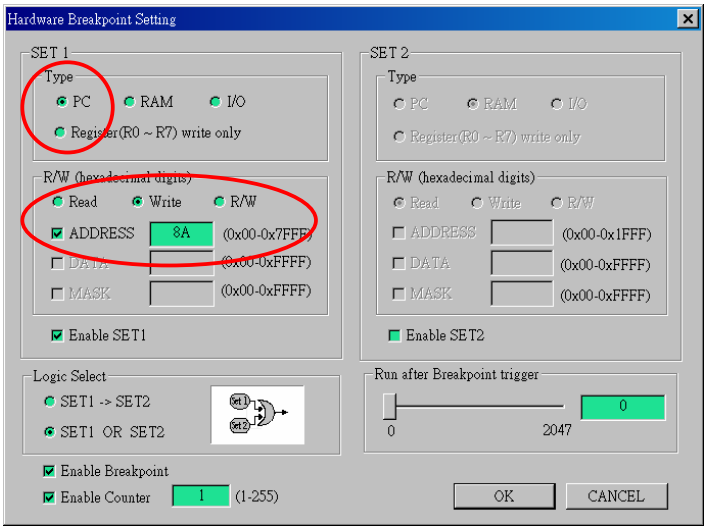
C.1.1 PC Counter Break (Read/Write)

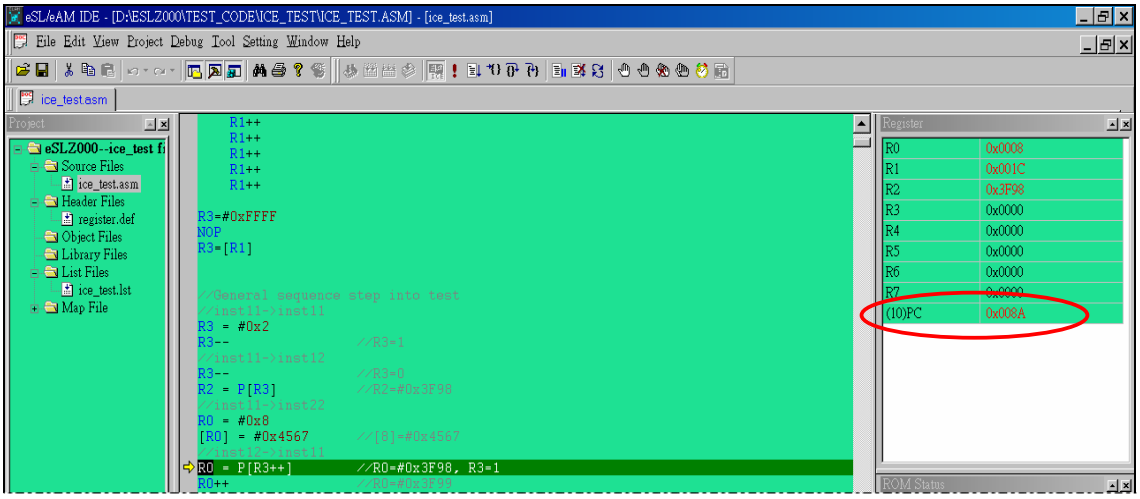
You can set an immobile PC value to trigger break. The PC break setting only support address break (read, write and read/write), data and mask can't be set in dialog.

PC range from 0x0000 to 0x7FFF

For example:

If user set PC break value as 0x008A, logical function as SET1 OR SET2, Loop counter as “1”, Run after breakpoint trigger as “0”. After this setting, the system will generate a breakpoint trigger at PC = 0x8A.





C.1.2 RAM Break (Read/Write)

The data memory breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, in addition, every mode support Data memory Read, Data memory Write and Data memory Read or Write.

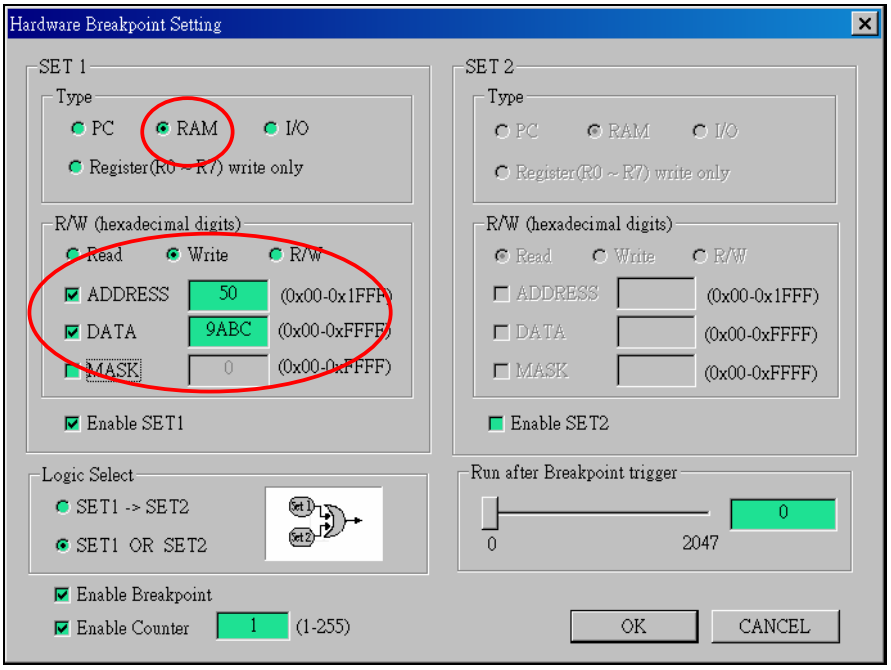
Data memory address from 0x000 to 0x1FFF for eSLZ000 platform, others from 0x000 to 0x07FF

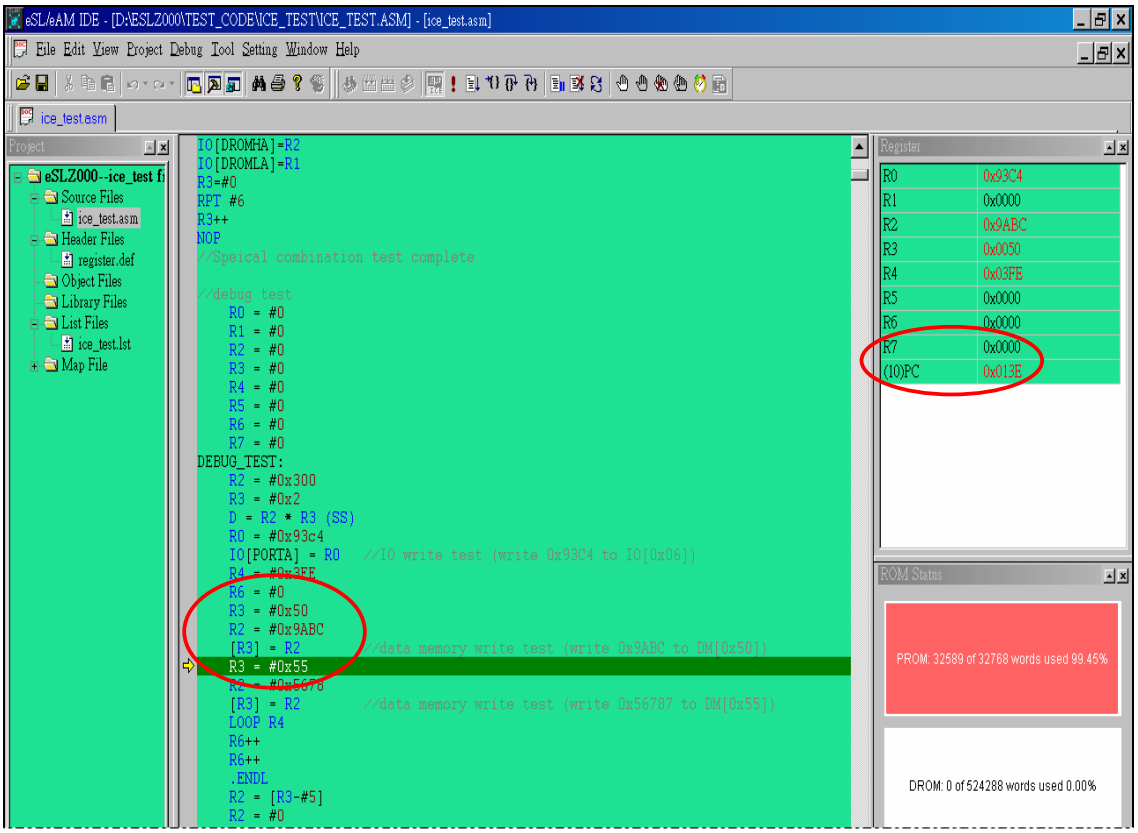
Data memory data from 0x0000 to 0xFFFF

Mask data from 0x0000 to 0xFFFF

For example:

If user set RAM break condition as address with data write. The RAM address as 0x50, data as “0x9ABC”, logical function as SET1 OR SET2, Loop counter as “1”, Run after breakpoint trigger as “0”. After this setting, the system will generate a breakpoint trigger at PC = 0x013E.





C.1.3 I/O Break (Read/Write)

The I/O breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, in addition, every mode support Data Read, Data

Write and Data Read or Write.

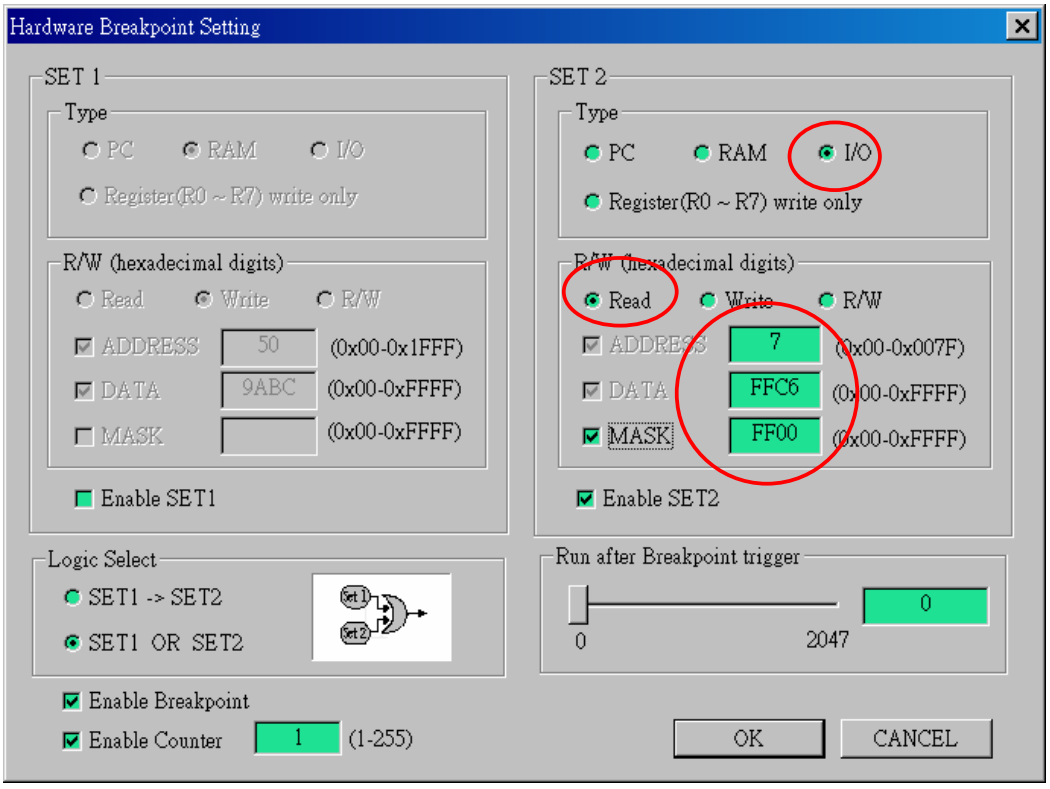
I/O address from 0x00 to 0x7F

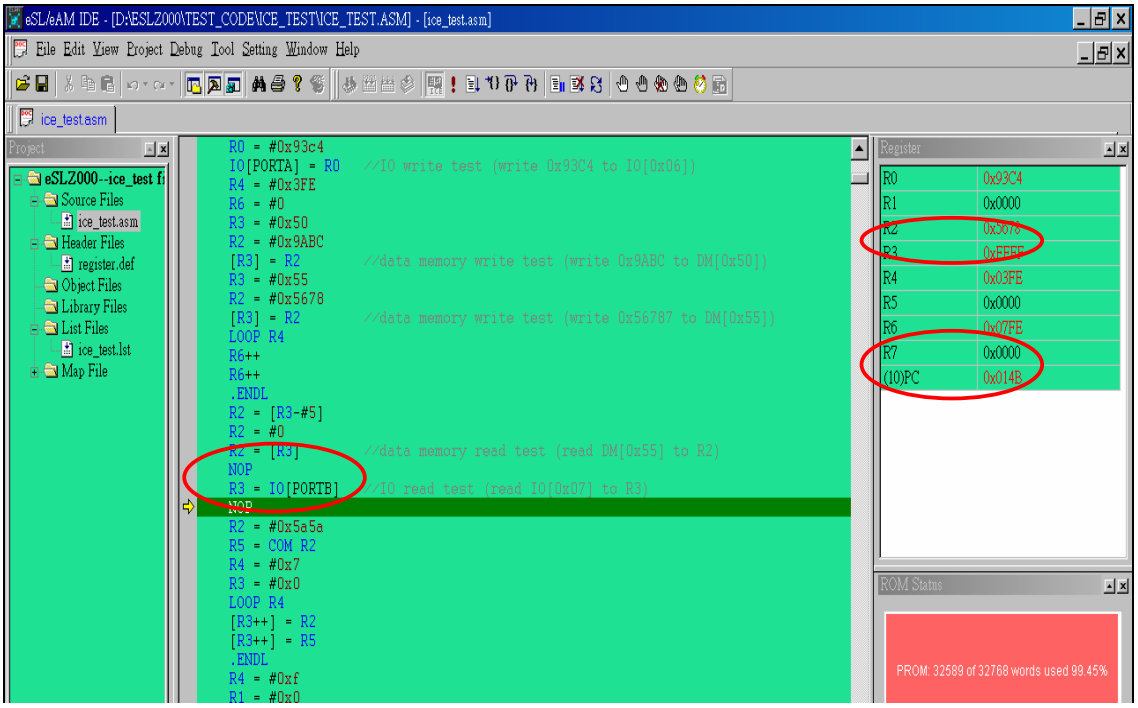
I/O data from 0x0000 to 0xFFFF

Mask data from 0x0000 to 0xFFFF

For example:

If user set IO break condition as address with data read with mask. The IO address as 0x07(PORTB), data as “0xFFC6”, mask as 0xFF00 (low byte don’t care), logical function as SET1 OR SET2, Loop counter as “1”, Run after breakpoint trigger as “0”. After this setting, the system will generate a breakpoint trigger at PC = 0x014B.





C.1.4 Register Break (R0~R7) (Write Only)

The register breakpoints can be set to one of three modes; address break, address with data break, address with data mask break, but in register domain only support address write, Data Write.

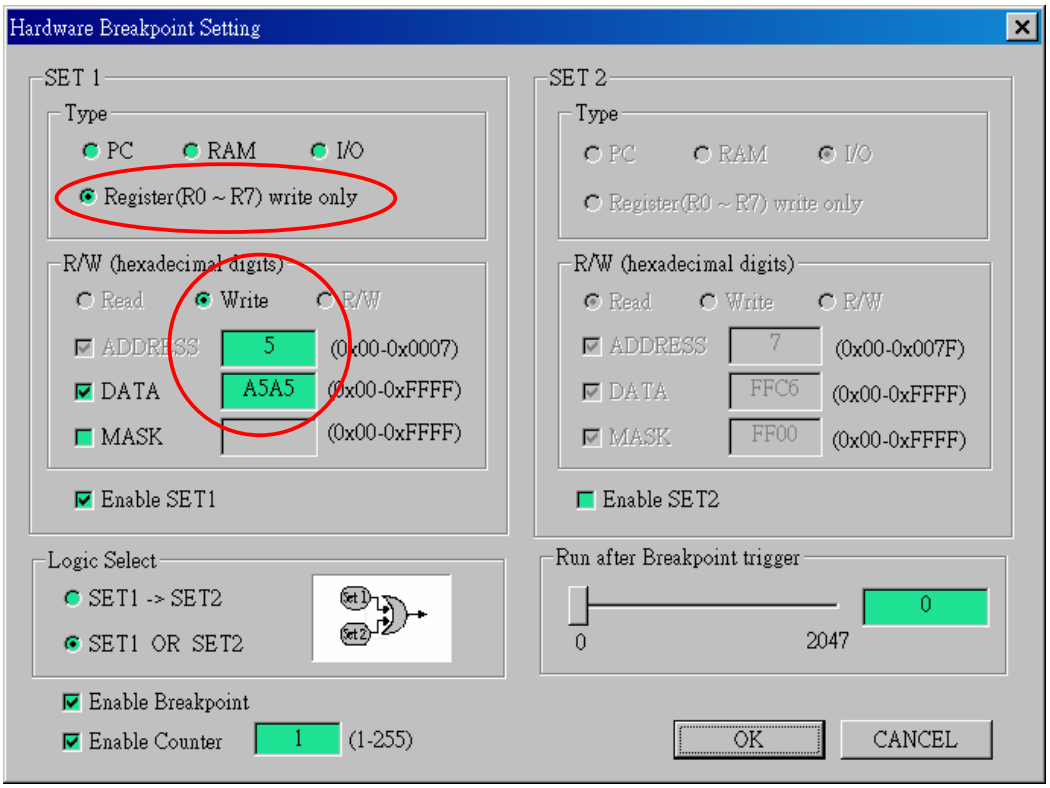
Register address from 0x0 to 0x7

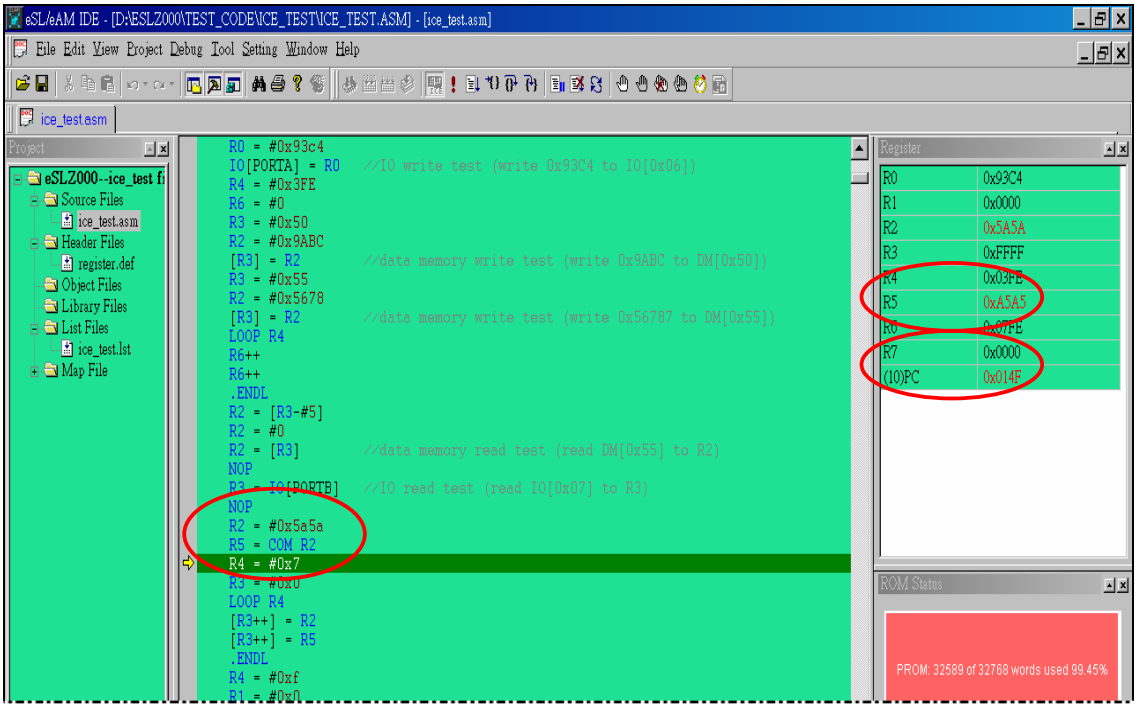
Register data from 0x0000 to 0xFFFF

Mask data from 0x0000 to 0xFFFF

For example:

If user set register break condition as address with data read. The register address as 0x05(R5), data as “0xA5A5”, logical function as SET1 OR SET2, Loop counter as “1”, Run after breakpoint trigger as “0”. After this setting, the system will generate a breakpoint trigger at PC = 0x014F.





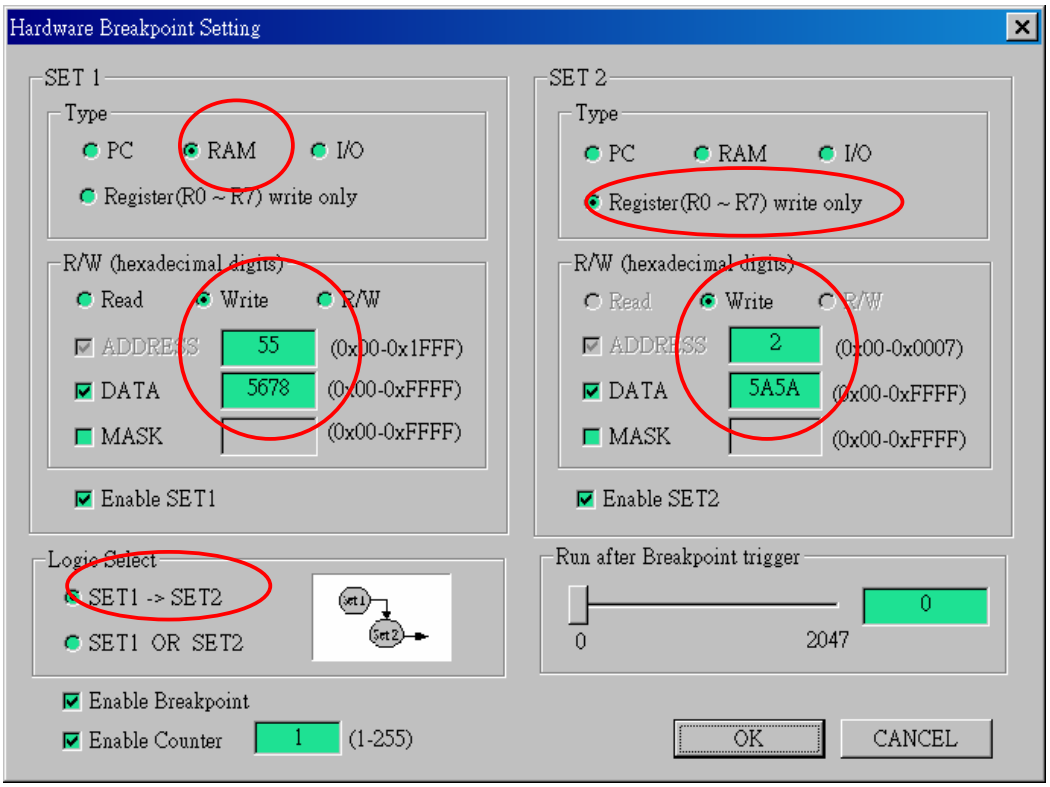
C.1.5 Logical Select

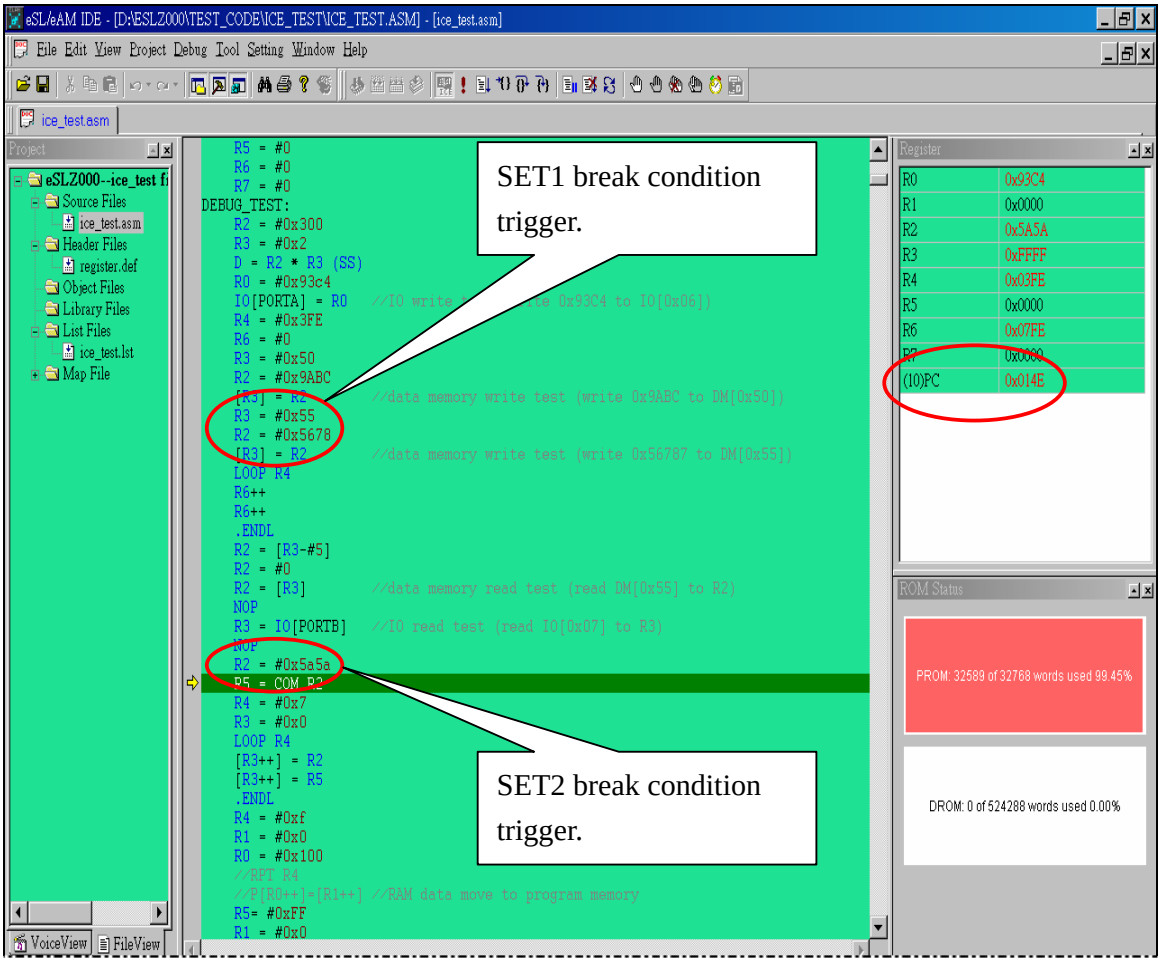
The H/W breakpoint mechanism supports two SET breakpoints, according to logical select menu, we can distinguish two kinds option for SET1 and SET2. Such as:

1. SET1 → SET2: this item means SET1 sequential to SET2. The SET1 condition must be trigger firstly then trigger SET2, the system will generate a breakpoint.
2. SET1 OR SET2: this item means both SET1 and SET2 can generate breakpoint. In other word, the SET1, SET2 are relationship of logical “OR”.

For example: SET1→SET2

If user set SET1 break condition as RAM break that address with data writ. The RAM address as 0x55, data as "0x5678". SET2 break condition as register break that address with data write. The address as 0x02 (R2), data as 0x5A5A, logical function as SET1 → SET2, Loop counter as "1", Run after breakpoint trigger as "0". After this setting, the system will generate a breakpoint trigger at PC = 0x014E.



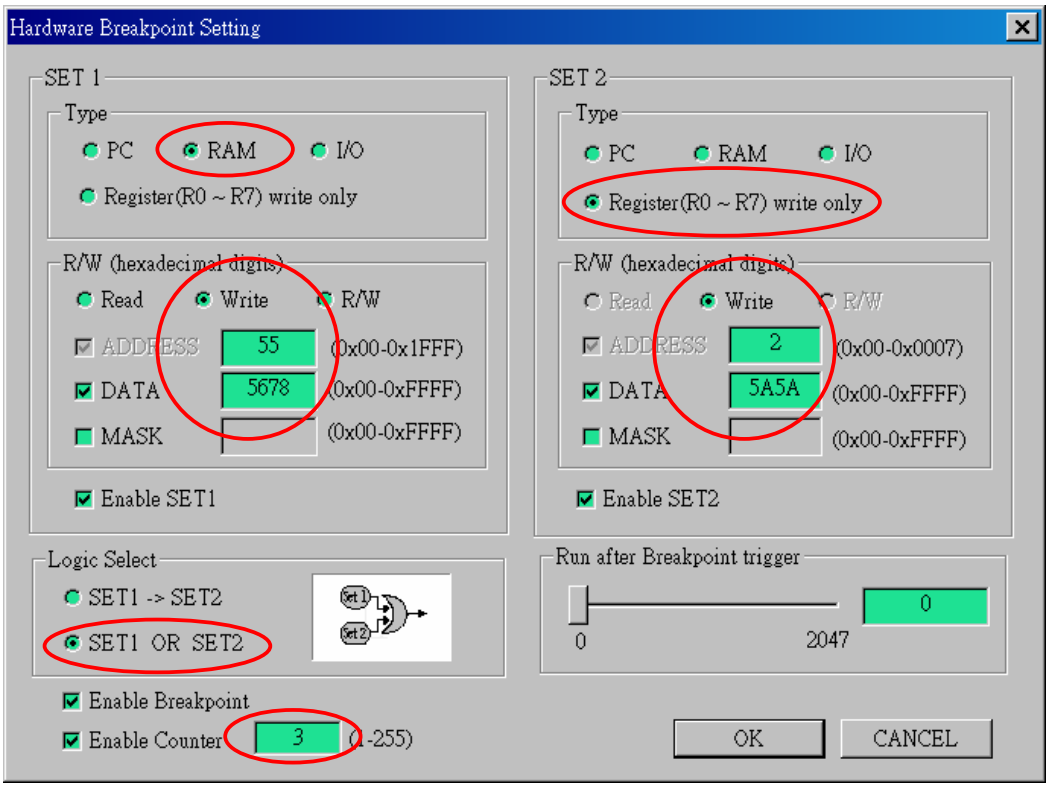


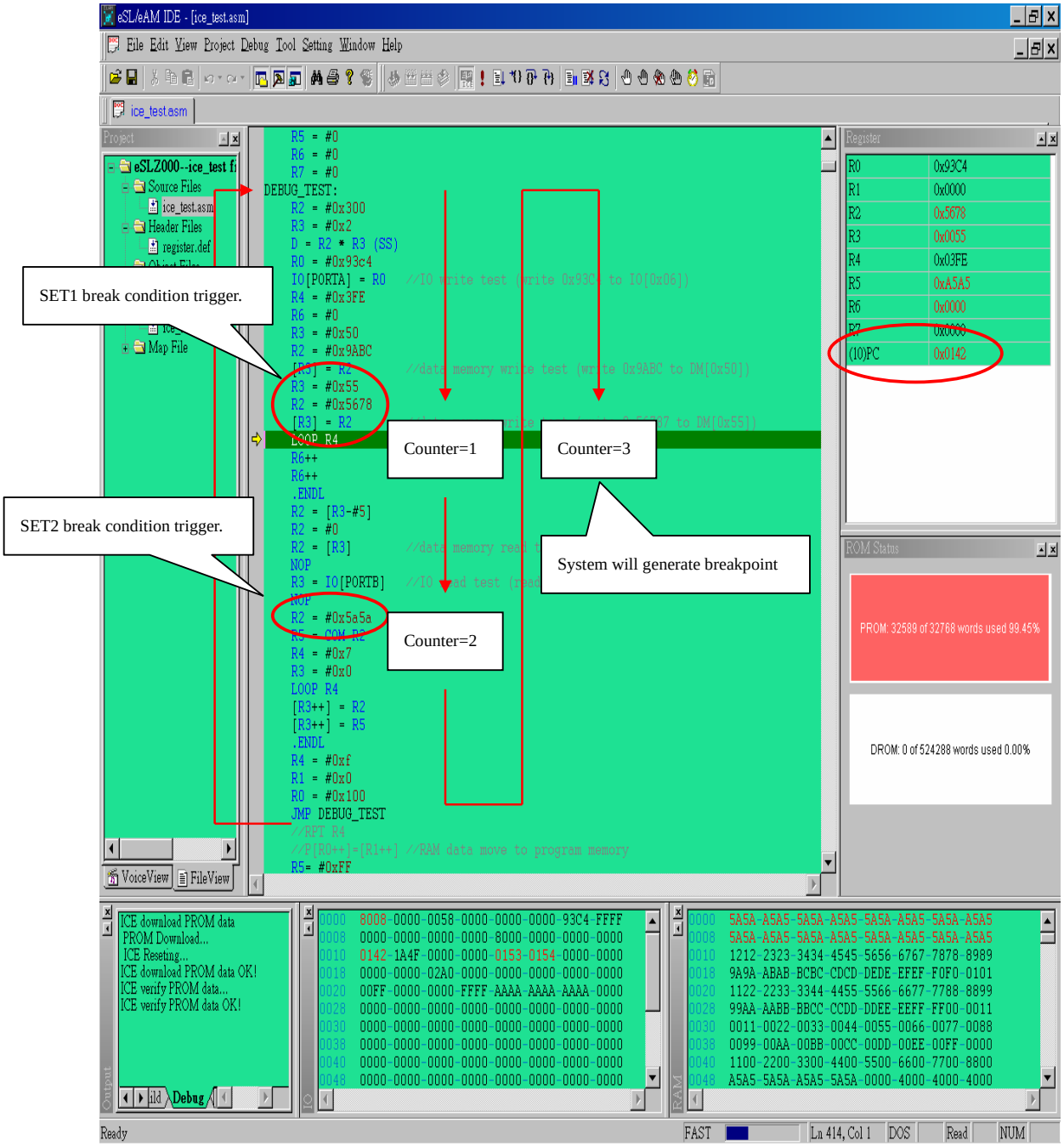
C.1.6 Loop Counter

The loop counter can be setting from 1 to 255 (default set to 1). If user defines logical select is SET1 OR SET2, the SET1 break and SET2 break will be count together. When SET1 break and SET2 break count times equal user define count times, the system will generate a breakpoint trigger. If user define logical select is SET1 → SET2, the loop count will be increase one only at SET1→SET2 break condition trigger.

Example 1: SET1 OR SET2

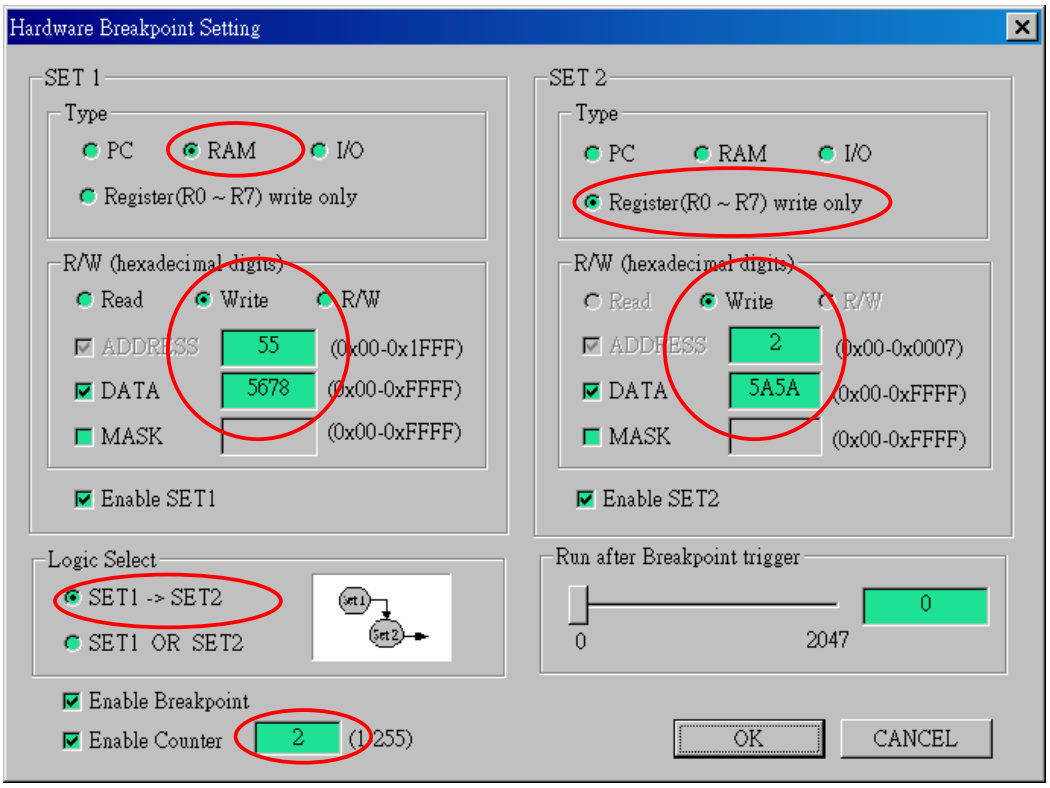
If user set SET1 break condition as RAM break that address with data writ. The RAM address as 0x55, data as “0x5678”. SET2 break condition as register break that address with data write. The address as 0x02 (R2), data as 0x5A5A, logical function as SET1 OR SET2, Loop counter as “3”, Run after breakpoint trigger as “0”. After this setting, the system will generate a breakpoint trigger at PC = 0x0142.




SET1 break condition trigger.
SET2 break condition trigger.
Counter=1
Counter=3
Counter=2
System will generate breakpoint

Example 2: SET1→SET2

If user set SET1 break condition as RAM break that address with data writ. The RAM address as 0x55, data as "0x5678". SET2 break condition as register break that address with data write. The address as 0x02 (R2), data as 0x5A5A, logical function as SET1 → SET2, Loop counter as "2", Run after breakpoint trigger as "0". After this setting, the system will generate a breakpoint trigger at PC = 0x014E.



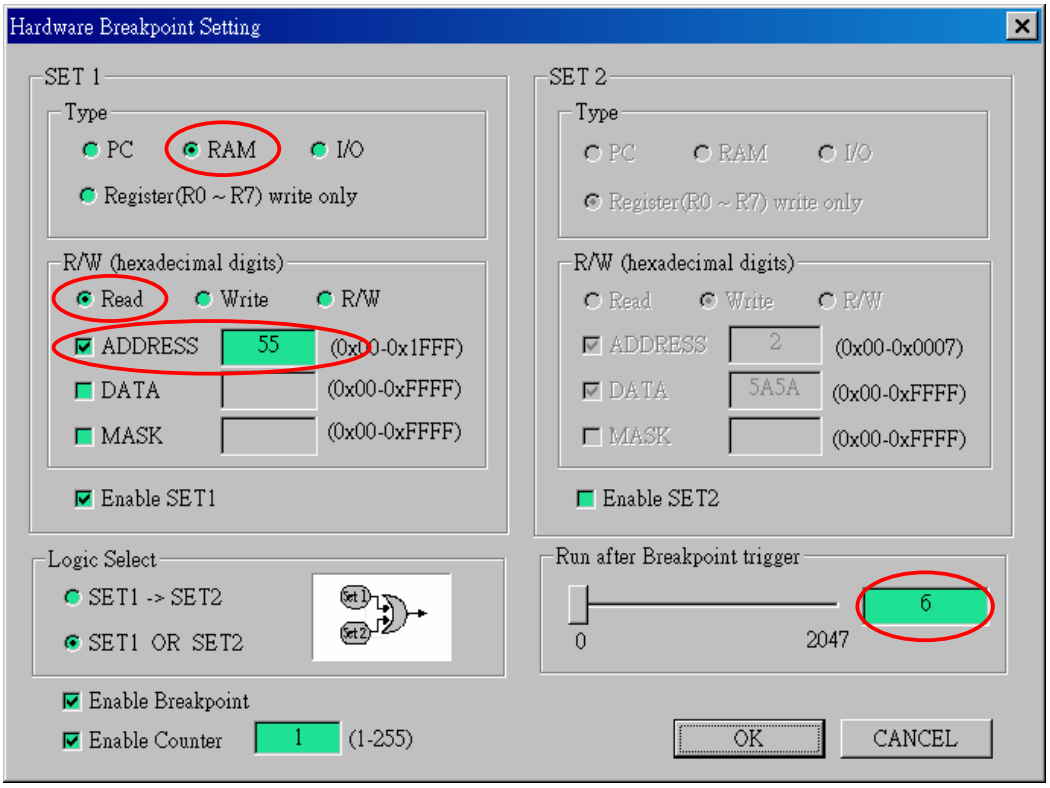
SET1 break condition trigger.
SET2 break condition trigger.
Counter=1
Counter=2
System will generate breakpoint

C.1.7 Run After Breakpoint Trigger

This item means the system will run how many instructions after break has trigger. The dialog can be fit instruction number from 0 to 2047. When break has trigger (whether SET1 condition occur firstly or SET2), the instructions counter will start. If SET1 has trigger and instructions number over than SET2, the SET2 break can't be trigger. The same as SET2 has trigger and instructions number over than SET1, the SET1 break can't be trigger. (Note: RPT instruction as one instruction number)

For example:

If user set SET1 break condition as RAM break that address read. The RAM address as 0x55, logical function as SET1 OR SET2, Loop counter as "1", Run after breakpoint trigger as "6". After this setting, the system will generate a breakpoint trigger at PC = 0x014E.



eSL/eAM IDE - [D:\ESLZ000\TEST_CODE\ICE_TEST\ICE_TEST.ASM] - [ice_test.asm]
File Edit View Project Debug Tool Setting Window Help
ice_test.asm
Project
eSLZ000--ice_test fi
Source Files
ice_test.asm
Header Files
register.def
Object Files
Library Files
List Files
ice_test.lst
Map File
VoiceView
FileView
R6 = #0
R7 = #0
DEBUG_TEST:
R2 = #0x300
R3 = #0x2
D = R2 * R3 (SS)
R0 = #0x93c4
IO[PORTA] = R0 //IO write test (write 0x93C4 to IO[0x06])
R4 = #0xFE
R6 = #0
R3 = #0x50
R2 = #0x9ABC
[R3] = R2 //data memory write test (write 0x9ABC to DM[0x50])
R3 = #0x55
R2 = #0x5678
[R3] = R2 //data memory write test (write 0x56787 to DM[0x55])
LOOP R4
R6++
R6++
.ENDL
R2 = [R3-#5]
R2 = #0
R2 = [R3] //data memory read test (read DM[0x55] to R2)
NOP
R3 = IO[PORTB] //IO read test (read IO[0x07] to R3)
NOP
R2 = #0x5a5a
R5 = COM R2
R4 = #0x7
R3 = #0x0
LOOP R4
[R3++] = R2
[R3++] = R5
.ENDL
R4 = #0xf
R1 = #0x0
R0 = #0x100
JMP DEBUG_TEST
//RPT R4
//P[R0++]=[R1++] //RAM data move
R5= #0xFF
R1 = #0x0
SET1 break condition trigger.
Run after breakpoint trigger number 6 instruction: NOP, R3=IO[PORTB], NOP R2.l=0x5a, R2.h=0x5a, R5=COM R2
Register
R0 0x93C4
R1 0x0000
R2 0x5A5A
R3 0xFFFF
R4 0x00FE
R5 0xA5A5
R6 0x01FE
R7 0x0000
(10)PC 0x014E
ROM Status
PROM: 32589 of 32768 words used 99.45%
DROM: 0 of 524288 words used 0.00%
Debug
0000 8008-0000-0058-0000-0000-0000-93C4-FFFF
0008 0000-0000-0000-0000-8000-0000-0000-0000
0010 014E-1A4F-0000-0000-0143-0144-0000-0000
0018 0000-0000-02A0-0000-0000-0000-0000-0000
0020 00FF-0000-0000-FFFF-AAAA-AAAA-AAAA-0000
0028 0000-0000-0000-0000-0000-0000-0000-0000
0030 0000-0000-0000-0000-0000-0000-0000-0000
0038 0000-0000-0000-0000-0000-0000-0000-0000
0040 0000-0000-0000-0000-0000-0000-0000-0000
0048 0000-0000-0000-0000-0000-0000-0000-0000
0000 FFFF-FFFF-FFFF-FFFF-FFFF-FFFF-FFFF-FFFF
0008 FFFF-FFFF-5A5A-A5A5-5A5A-A5A5-5A5A-A5A5
0010 4000-4000-4000-4000-4000-4000-4000-4000
0018 4000-4000-4000-4000-4000-4000-4000-4000
0020 4000-4000-4000-4000-4000-4000-4000-4000
0028 4000-4000-4000-4000-4000-4000-4000-4000
0030 4000-4000-4000-4000-4000-4000-4000-4000
0038 4000-4000-4000-4000-4000-4000-4000-4000
0040 4000-4000-4000-4000-4000-4000-4000-4000
0048 4000-4000-4000-4000-4000-4000-4000-4000
Ready
FAST
Ln 426, Col 1
DOS
Read
NUM

C.1.8 Hardware Breakpoint Supported Instructions

1. **PC break:** all instructions type can support, but RPT inner instruction not supported.
2. **RAM break:** all instruction type can support, but RPT inner instruction not supported.
3. **I/O break:** only support following instruction type:
   a) BS IO[address].b (address from 0x0 to 0xF)
   b) BC IO[address].b (address from 0x0 to 0xF)
   c) BTG IO[address].b (address from 0x0 to 0xF)
   d) Rd = IO[address] (address from 0x0 to 0x7F)
   e) IO[address] = Rs (address from 0x0 to 0x7F)
   f) PUSH IO[address] (address from 0x0 to 0x7F)
   g) POP IO[address] (address from 0x0 to 0x7F)

   NOTE
   RPT inner instruction not supported

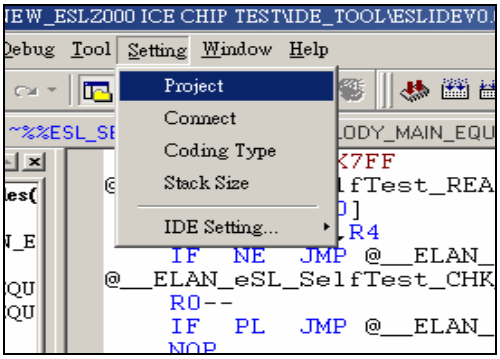
4. **Register break:** only supports the following instructions:
   a) Rd = Rs operate Rt
   b) Rd = operate Rs
   c) Rd = Rs
   d) Rd = [Rs]
   e) Rd = RAM address
   f) Rd = #imm16
   g) Rd = #imm8
   h) [Rd++] = Rs
   i) [Rd--] = Rs
   j) [Rd++] = P[Rs++]
   k) [Rd--] = P[Rs--]
   l) POP Rd
   m) SWAP Rd

   NOTE
   RPT inner instruction not supported

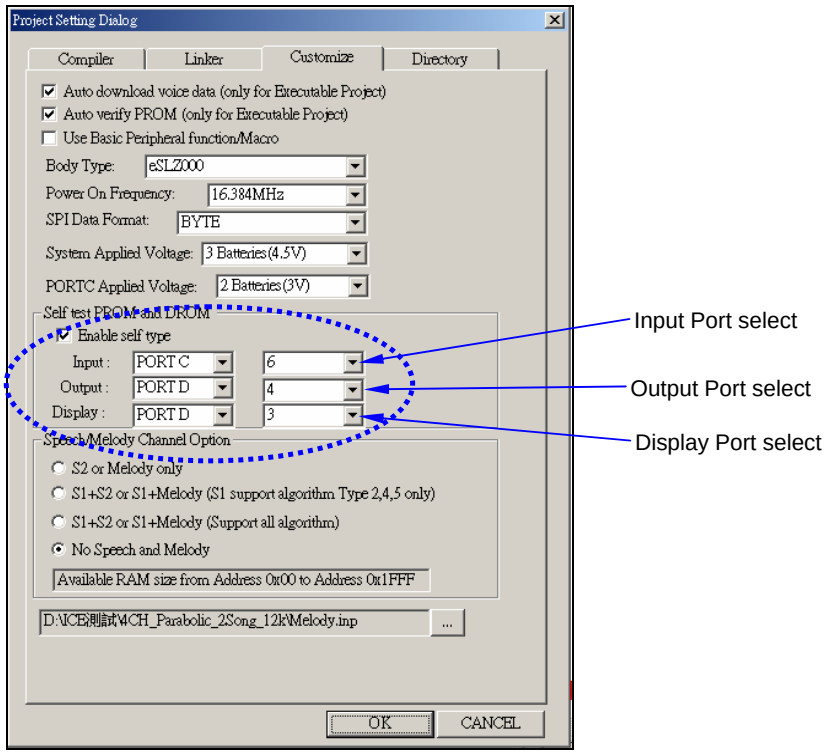
Appendix D
How to Use Self Test

D.1 IDE Tool Self Test Function Setting

After opening an existing or new project, click the “Setting” menu and click “Project”

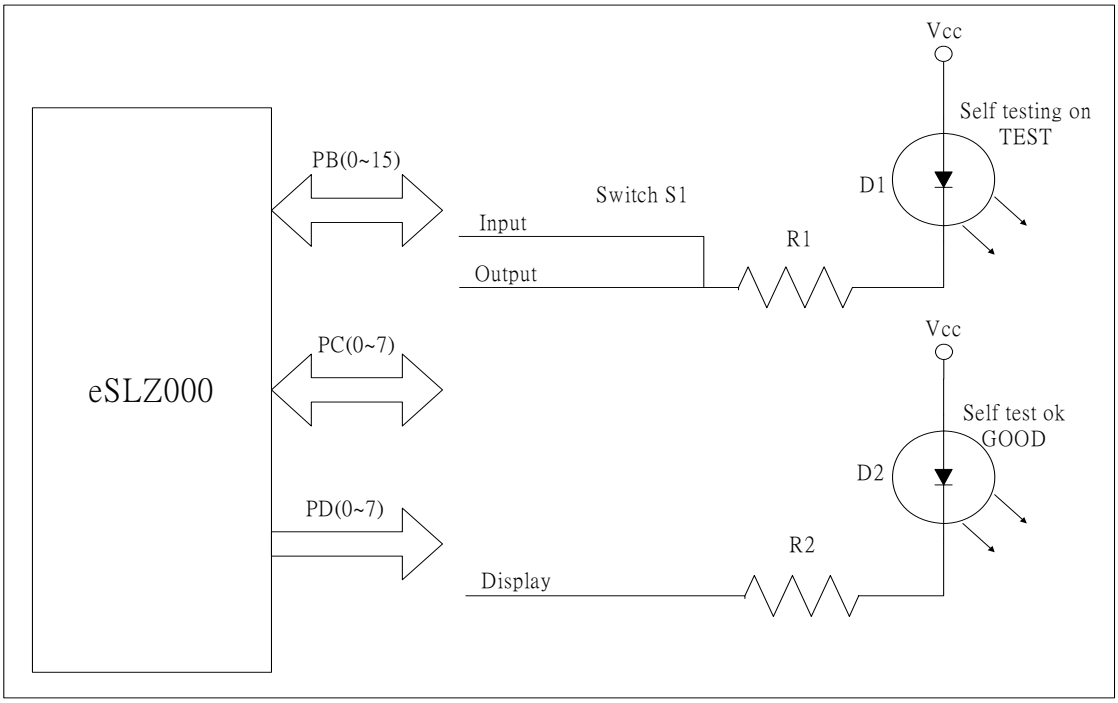


From Project Setting Dialog, enable the “Enable self type” check box to allow IO port setting.


Project Setting Dialog
Compiler
Linker
Customize
Directory
Auto download voice data (only for Executable Project)
Auto verify PROM (only for Executable Project)
Use Basic Peripheral function/Macro
Body Type: eSLZ000
Power On Frequency: 16.384MHz
SPI Data Format: BYTE
System Applied Voltage: 3 Batteries (4.5V)
PORTC Applied Voltage: 2 Batteries (3V)
Self test PROM and DROM
Enable self type
Input : PORT C 6
Output : PORT D 4
Display : PORT D 3
Speech/Melody Channel Option
S2 or Melody only
S1+S2 or S1+Melody (S1 support algorithm Type 2,4,5 only)
S1+S2 or S1+Melody (Support all algorithm)
No Speech and Melody
Available RAM size from Address 0x00 to Address 0x1FFF
D:\ICE測試\4CH_Parabolic_2Song_12k\Melody.inp
...
OK
CANCEL
Input Port select
Output Port select
Display Port select

D.2 Self Test I/O Application Circuit

When power is switched ON, output signal is initially “High” then turns to “Low”. At the same time, D1 is turned ON and enters into the self testing mode.When self testing is completed, output signal becomes “High” and D1 turns OFF. If checksum fails (Display = 1), D2 will then turns OFF. Otherwise, (checksum Ok), D2 is turn ON..



Input pin can be anyone of PORTB(15~0) or PORTC(7~0)

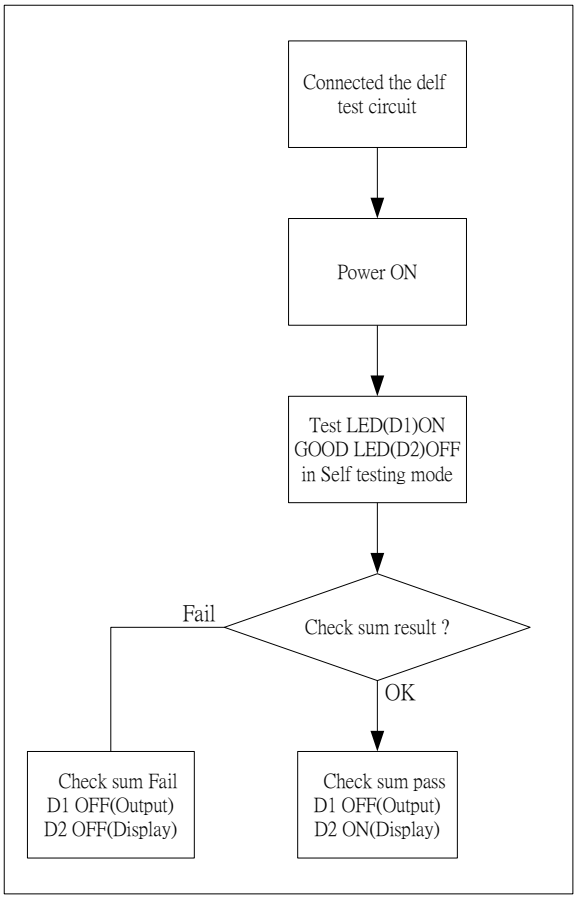
Output pin can be anyone of PORTB(15~0) , PORTC(7~0) or PORTD(7~0)

Display pin can be anyone of PORTB(15~0) , PORTC(7~0) or PORTD(7~0)

NOTE

1. *Because the initial value of the PORTD is Low, D1 and D2 are turned ON after power on.*
2. *The I/O pin setting number should not be the same in input, output, and display.*
3. *When checksum is fails, the program jumps into the infinite loop*

D.3 Self Test Flow Chart

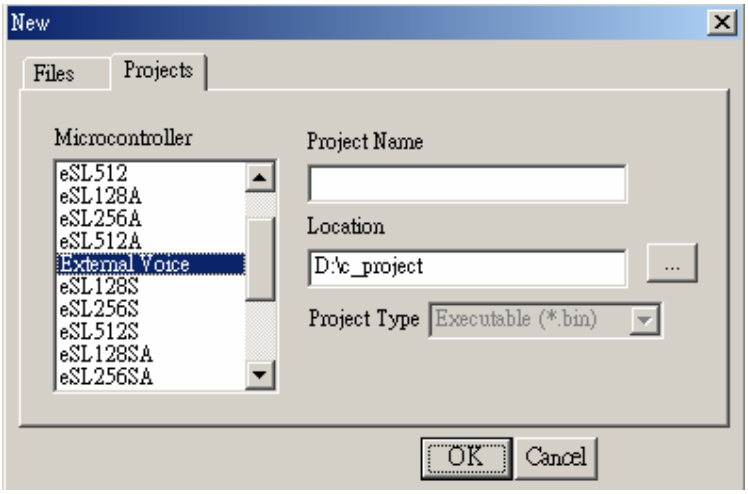

Connected the delf test circuit
Power ON
Test LED(D1)ON GOOD LED(D2)OFF in Self testing mode
Check sum result ?
Fail
OK
Check sum Fail D1 OFF(Output) D2 OFF(Display)
Check sum pass D1 OFF(Output) D2 ON(Display)

Appendix E
How to Create and Use External Voice Project

E.1 Create SPI Voice Project

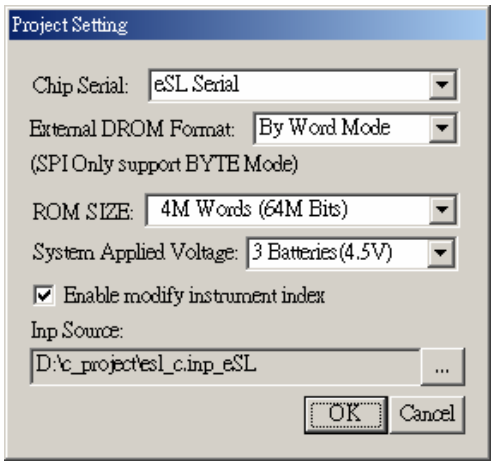
Besides internal DROM, it could be played from external ROM or SPI flash. You could use External project to set related instrument and samples. There were some steps as followed.In External voice project:

1. Create a new External Voice project.



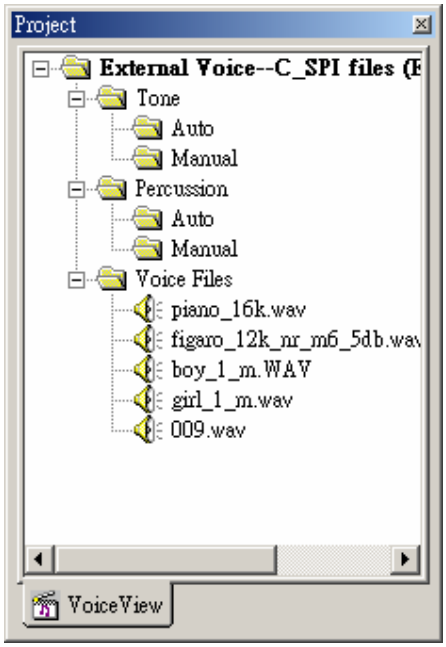
2. In the project option of setting, you could choose Chip Serial and ROM Size. If you would like to change instrument index, you must enable the option of modify instrument index. Then, you could change instrument index according to instrument index of your melody project. Users could select your designate INP_eSL.Yout also can change DROM data format by select External DROM Format option.

> **NOTE**
>
> *SPI only supports **Byte mode** data. If you want download data into SPI flash, you must select **By Byte mode** at External DROM Format.*

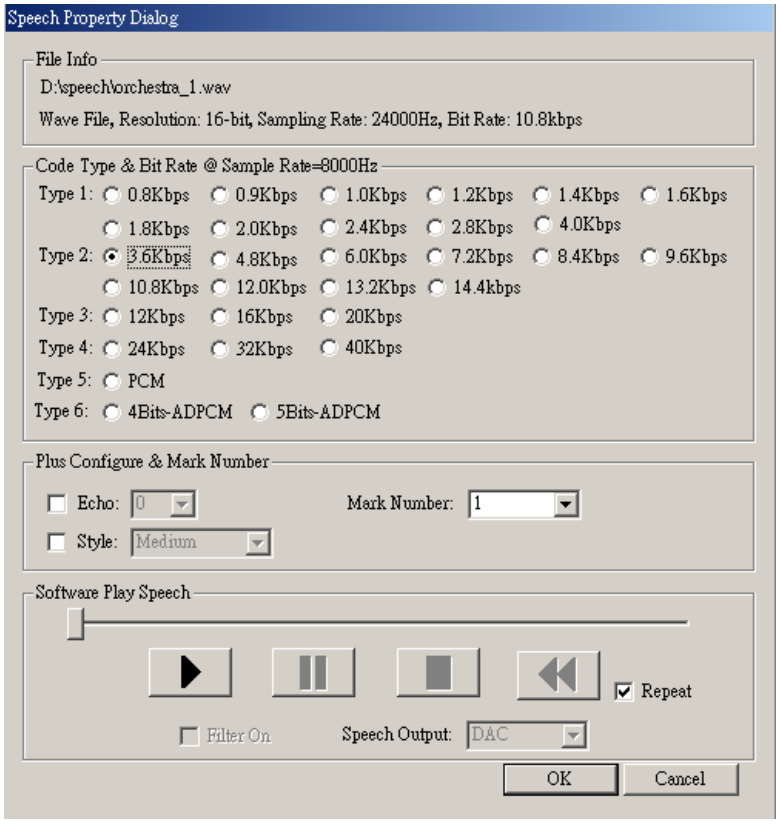


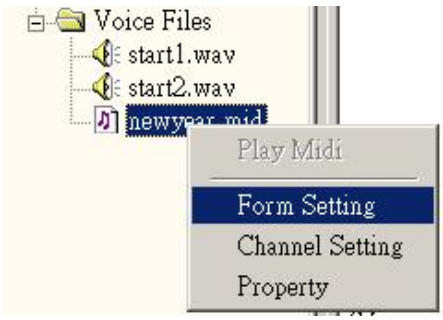
E.2 Add file into SPI Voice Project

Add your voice files (including speech, midi or user data files) in your order. The order of example is that “start1.wav”, “start2.wav”, and “newyear.mid” are 1, 2, and 3.

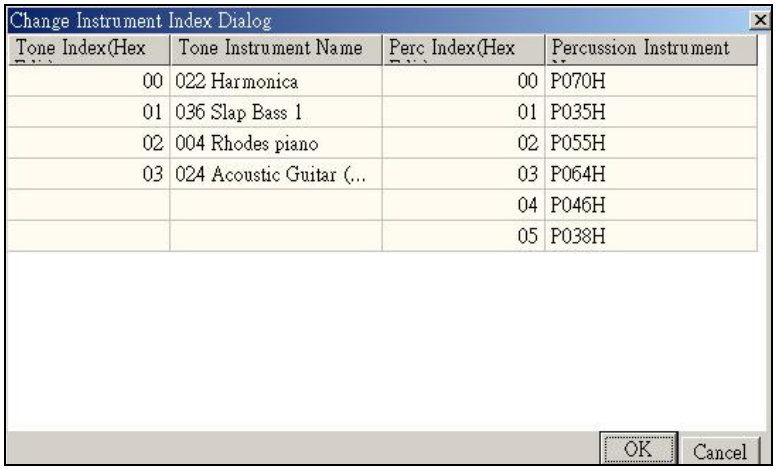


You can set related speech option on speech property dialog. You could set related melody option, including form setting, channel setting, and property.

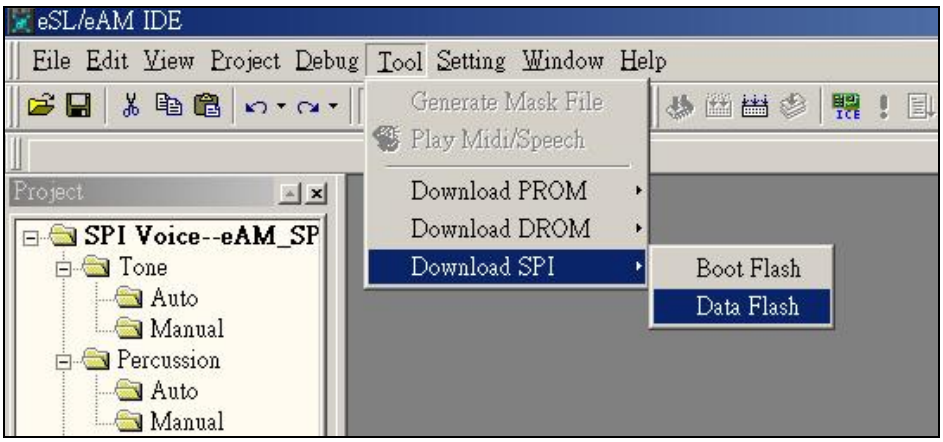




When you build External project, if you enabled modify instrument index option, it opened modify instrument index dialog. You could modify instrument and percussion index according to your melody project.



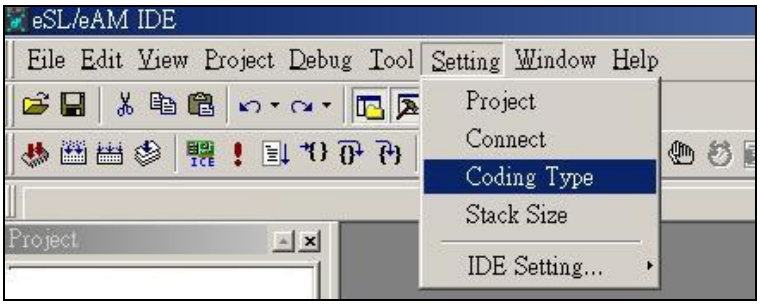
Finally, down data to external data flash

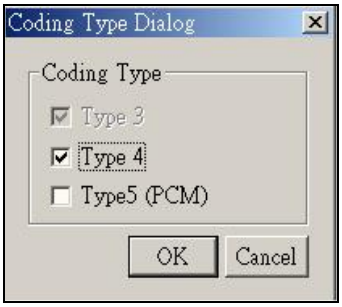


E.3 Other Settings

E.1.1 Speech Project

If the coding type of speech was not selected in speech project, user must manually insert new coding type from coding type setting option. The SPI speech play setting would be completed. User could play speech from external SPI flash.





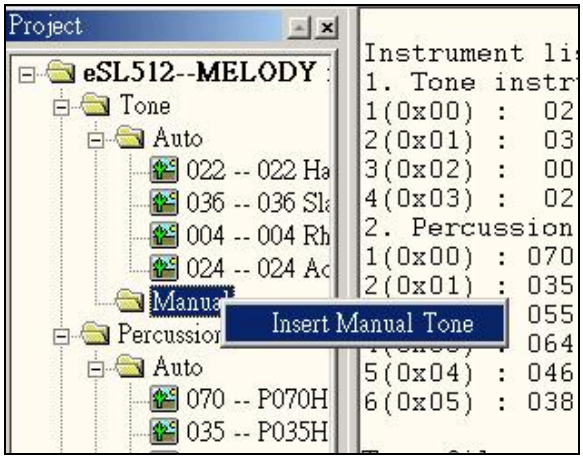
E.1.2 Melody Project

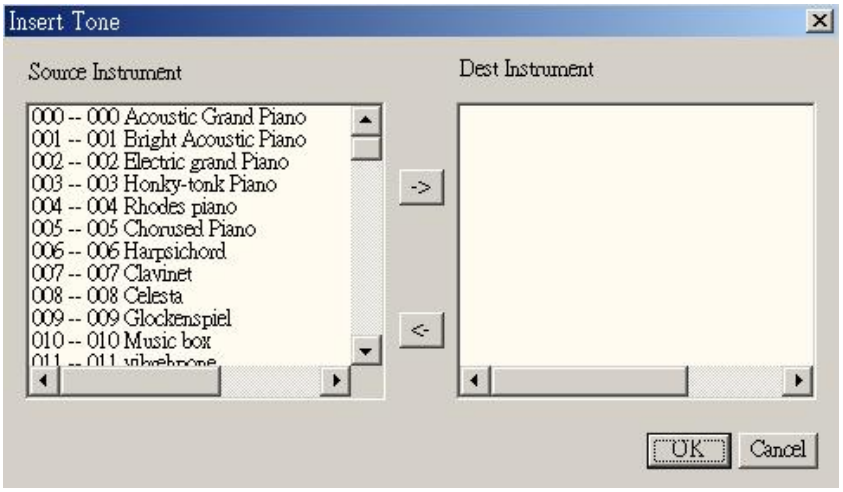
1. First, users must know related instrument list, percussion instrument list. Tone file and percussion file would show out *.vlg file in SPI and melody project. Users must combine related tone instruments and percussion instruments in SPI and melody project. So users could insert new instruments, percussion instruments, tone files and percussion files in melody project.

   NOTE Instrument, percussion instrument, tone and percussion files are in *.vlg file of project.

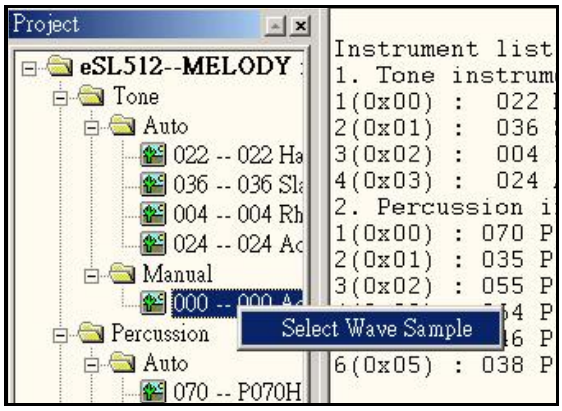
```
=====================================================================
1.[Tone]
  (Auto)
    1(0x00) pst: ' 022 Harmonica'
                 smp: '022_C5' = 43929 words
                 smp: '022_C6' = 5353 words
    2(0x01) pst: ' 036 Slap Bass 1'
                 smp: '036_C3' = 15215 words
    3(0x02) pst: ' 004 Rhodes piano'
                 smp: '004_C5' = 23706 words
                 smp: '004_C6' = 10728 words
    4(0x03) pst: ' 024 Acoustic Guitar (Nylon)'
                 smp: '024_C4' = 17957 words
                 smp: '024_C5' = 13579 words
                 smp: '024_C6' = 7774 words
    ---------------------------------------------------------
                                    sum = 138241 words
  (Manual)
    ---------------------------------------------------------
                                    sum = 0 words

2.[Percussion]
  (Auto)
    1(0x00) smp: '035 P035H' = 1501 words
    2(0x01) smp: '038 P038H' = 2917 words
    3(0x02) smp: '046 P046H' = 21678 words
    4(0x03) smp: '055 P055H' = 20686 words
    5(0x04) smp: '064 P064H' = 3766 words
    6(0x05) smp: '070 P070H' = 1374 words
    ---------------------------------------------------------
                                    sum = 51922 words
  (Manual)
    ---------------------------------------------------------
                                    sum = 0 words
```

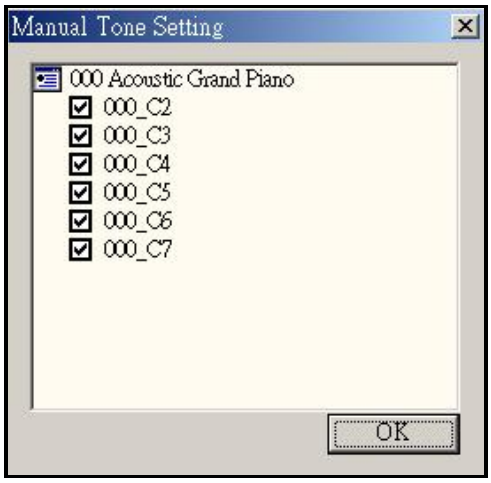
2. If there were not related instrument or percussion instrument in melody project, you could insert manual instruments from manual dialog. User could insert desired instruments.





3. After inserted manual instrument or percussion instrument, user could select related wave samples.





4. Finally, you rebuilt melody project and run user's melody project on ICE chip.